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THE CHEMICAL BRANCH.

FIELD EXPERIMENTS OF THE CHEMICAL BRANCH FOR THE YEAR 1901.

By F. J. Howell, Ph.D.

In the Report of the Recess Committee (House of Commons) on the Establishment of a Department of Agriculture and Industries for Ireland, 1897, will be found a valuable and interesting contribution by Tisserand, Director of Agriculture of France. In a paper entitled "An Ideal Department of Agriculture and Industries," Tisserand gives a wealth of suggestion, specially valuable, perhaps, to our Department at the present moment. There is no intention here to treat of those suggestions in detail, but one reference only will, I hope, serve to introduce and bring into prominence the importance of the subject I shall deal with in this paper. Speaking of the necessity of co-operative agricultural experiments, Tisserand writes: "It is with the assistance of skilful farmers that the French Administration establishes every year from 3,000 to 4,000 demonstration fields, in which the agriculturists can see with their own eyes the trials of the best kinds of crops and the use of the most appropriate manure. It costs the Ministry in the purchase of seeds, manures and implements, and the expense of superintendence, some 150,000 to 170,000 francs a year to give all our peasants a living illustration of the progress which may easily be realized by each of them. Few institutions have brought about greater or more rapid progress among the class of small cultivators. I cannot too strongly urge you to have recourse to them."

What Victoria has Done.

It must be remembered that in addition to this extensive system of co-operative experiments on the farms throughout the country, there is, and long has been, in France a large number of elaborate and well-equipped Experiment Stations, or farms, where exhaustive tests are being made in everything that might assist in the progress of agriculture; and it is the result of such preliminary tests that are afterwards introduced with full confidence in the demonstration field of the farm. In Victoria we have not a single institution which can rightly lay claim to the designation of an Experiment Station, and the wealth of experience that might now be waiting for application had such an institution existed has yet to be gathered in the years ahead of us. The fault does not lie with the officers of the Department, for when the history of this Department is written, as I suppose it will be some day, the fact will be made clear that there were officers who fought doggedly and persistently for the introduction of some systematic scheme of field experimenting. If such a claim had found recognition the present clamour for information from the farmer could be met by answers which to-day are not available.

The Work of Mr. Pearson.

It was the absence of the official experimental farm that caused field experimenting in Victoria to assume the co-operative form that it did, and to no man in the State are the large developments which have taken place in this direction so largely due as to Mr. A. N. Pearson. I think Mr. Pearson may be justly termed the father of a truly scientific system of field experimenting in Victoria. It has been my advantage and my pleasure to have co-operated with him in the more recent and larger developments of this branch of his work; and although he has, unfortunately, severed his connexion with this Department, the readers of this journal will, I hope, remember that to his hand, perhaps, more than to my own, must be ascribed the larger share of the directing control of work, the full reports of which will have to be given by me long after his departure.

The earliest of Mr. Pearson's field experiments commenced thirteen years ago on the farm of the late Mr. Goldie, at Port Fairy. From that time on the Chemist for Agriculture has worked patiently and persistently against much opposition and much prejudice, varied at times with some little sympathy and support. The dogged courage with which he has clung to the works is finding its full reward at a moment when he has to leave us. From one farm at Port Fairy the experiments have so extended till they now embrace the whole of our State, and the difficulty last year was to limit applications for co-operative support among farmers, and not to secure them. It has been my fortune to have been able to assist Mr. Pearson in this great movement. The lecture, as I pointed out in the last number of this journal, has played an effective part, and the great forward move on the part of the farmer has only taken place within the last two years.

The Fields of 1900 and 1901.

In the year 1900 there were 270 experimental manure fields established on the various farms throughout the State. Last year the figure jumped to 471, while there were numerous applications which had to be declined for want of funds. Full details of the methods employed in laying out these fields have been given in my Annual Report of last year. The crops experimented on were as follow:—

Wheat.	Oats.	Barley.	Maize.	Peas.	Potatoes.	Wheat Varieties.	Beet-root.
186	46	3	6	7	17	103	31

Fodder Crops.	Flax.	Hops.	Grass.	Fruit.	Other Special Plots.
7	1	1	6	49	7

Distribution of the Plots.

The manure tests are distributed nearly all through the State, and extend from near the South Australian border on the one side, to Orbost on the other. The western, central, southern, northern, north-eastern and Gippsland districts are all represented, although, as in the preceding year, it is principally in our great wheat-growing area that the experiments have been carried out in the greatest number. In much of this portion of the State the plots have almost filled their primary purpose of demonstrating to all the increased yields which might follow

the use of a suitable manure, and a decline in numbers will probably take place in this part of our State; although there should always exist a limited number even there to answer certain special questions. It is on the poorer and medium class lands and grazing areas of the west and south that the idea ought now to be more largely taken up. It will yet be shown that as much can be done on this class of land in these portions of the country by the use of manure as in the northern parts of the State; and, when the necessity of manuring our pastures as well as our crops has been recognised, the dairying industry will again receive a fresh impetus.

Manuring Tests on Cereals.

These differ from the preceding year, and the fields in this case may be regarded more in the light of demonstration than experimental fields, although they have been so arranged as to answer both purposes. They are demonstration fields in as far as they will show to the farmer the increased yields following the use of a phosphatic manure, while their experimental nature consists in the tests to determine the suitable quantity of that manure required, and the most effective method of its application. They are experimental also in their tests with a nitrogenous fertilizer, both in difference of form, method, and time of application. Modifications have been introduced to answer the special requirements of the soil and climate of each district, but the following may be taken as the tests of a field in its simplest form.

Treatment of experimental manure plots in dry districts.

The plots receive the following quantities of manure per acre :—

Plot 1.—11 lbs. Concentrated Superphosphate
„ 2.—No Manure
„ 3.—22 lbs. Concentrated Superphosphate
„ 4.—33 lbs. do. do.
„ 5.—No Manure
„ 6.—51 lbs. Ordinary Superphosphate
„ 7.—54 lbs. Thomas Phosphate
„ 8.—No Manure
„ 9.—46 lbs. Bonedust
„ 10. { 51 lbs. Ordinary Superphosphate / 48 lbs. Sulphate of Ammonia
„ 11.—No Manure
„ 12. { 51 lbs. Ordinary Superphosphate / 87½ lbs. Dried Blood.

The manuring is arranged on a basis of 10 lbs. of phosphoric acid to the acre as a medium dressing, 5 lbs. for a light dressing, and 15 lbs. for a heavy dressing.

This is the experimental field in its simplest form, and has been called the A field, but it by no means answers all the questions we are desirous of knowing concerning our soils, and the action of the manures we apply; and, to get further information in this direction, there has been put down in each district a limited number of fields of a more exhaustive kind, arranged to answer a number of special questions, the knowledge of which might be supposed to result in information of practical value to the farmer. It must not be supposed, however, that

even such tests by any means cover the full field of inquiry. It will be remembered that these fields are situated on the private farms throughout the State, and not at an experiment station under Government control. It is a co-operative undertaking between the farmer and this branch, in which the farmer is put to a good deal of extra trouble, and receives for the most part no remuneration for it; and these circumstances naturally require consideration in drawing up a system of experimenting. The following are some of the special sets referred to. The plots 13, 14, and 15 in each case are in addition to the twelve plots of an A field :—

Set	Plot	Manure
Set B	Plot 13.	22 lbs. Concentrated Superphosphate 56 lbs. Gypsum
	„ 14.	—No Manure
	„ 15.	—68 lbs. Raw Guano
Set C	„ 13.	—51 lbs. Ordinary Superphosphate applied as a top dressing after crop has come up
	„ 14.	—No Manure
	„ 15.	51 lbs. Ordinary Superphosphate drilled in with the seed 48 lbs. Sulphate of Ammonia applied as a top dressing six weeks after sowing
Set D	„ 13.	—1 cwt. Lime
	„ 14.	—No Manure
	„ 15.	51 lbs. Ordinary Superphosphate 48 lbs. Sulphate of Ammonia 28 lbs. Potash Chloride
Set F	„ 13.	—51 lbs. Maldon Island Superphosphate
	„ 14.	—No Manure
	„ 15.	—51 lbs. Renard's Superphosphate
	„ 16.	—51 lbs. Bell's do.
	„ 17.	—No Manure
	„ 18.	—51 lbs. Wischer's Superphosphate
Set F	„ 13.	—1 cwt. Ordinary Superphosphate drilled in with seed
	„ 14.	—No Manure
	„ 15.	—1 cwt. Ordinary Superphosphate ploughed in before sowing
Set G	„ 13.	—51 lbs. Ordinary Superphosphate, the plot to be horse-hoed
	„ 14.	—No Manure
	„ 15.	—No Manure, but hoed the same as plot 13.

An Examination of the Tests of the Special Fields.

In Set B it will be seen that the medium dressing of a superphosphate has been tried in conjunction with gypsum, and the superphosphate in plot 15 replaced by its equivalent in raw guano. The tests in the other sets include the application of lime, and a complete manure in the place of a partial manure, that is, a manure containing the three plant foods, nitrogen, phosphoric acid, and potash, instead of nitrogen and phosphoric acid only. Analysis has shown that our northern soils generally are so rich in potash that the inclusion of this plant food in the manure we apply can be regarded as quite unnecessary

but plot 15 in Set D is for comparing the return of the field with the analytical results of the laboratory. It will be remembered, also, that in the fields of 1900 the application of a nitrogenous fertilizer failed generally to produce any increase in our cereal crops, and, in fact, appeared in cases to produce the opposite result. Notwithstanding these negative results, these tests have been repeated for 1901, but in a modified form. The only nitrogenous manure used last year in our cereals was nitrate of soda, and this was sown at the same time as the crop. In the 1901 experiments nitrogen has been given both in the form of sulphate of ammonia and blood manure; and, as plot 15 in set C shows, the sulphate of ammonia has in cases been applied as a top dressing six weeks after sowing.

Methods of Applying a Phosphatic Manure.

It is generally assumed that the small quantity of a superphosphate applied with the drill would not produce anything like the same results given broadcast. This might be correct, but certain results obtained quite accidently where the application did not take place with the drill gave reasons for questioning the correctness of this belief. As one case in point, the results of Mr. Telford's field, at St. Arnaud, in the year 1899, will be remembered. The manure delivery of the drill broke down at an early stage in the operations, and the seed was drilled in, and the manure afterwards sown broadcast as a top dressing.

The returns of this field were :—

Plot	1.—10 lbs. Concentrated Superphosphate	yielded	16·46	bushels.
"	2.—No Manure	"	12·51	"
"	3.—20 lbs. Concentrated Superphosphate	"	18·22	"
"	4.—30 lbs. " "	"	18·22	"
"	5.—No Manure	"	11·63	"
"	6.—26 lbs. Ordinary Superphosphate ...	"	15·58	"
"	7.—26 lbs. Thomas Phosphate ...	"	13·84	"
"	8.—No Manure	"	12·73	"
"	9. { 10 lbs. Concentrated Superphosphate / 20 lbs. Nitrate of Soda ... ... }	"	13·84	"
"	10. { 10 lbs. Concentrated Superphosphate / 40 lbs. Nitrate of Soda ... ... }	"	13·39	"
"	11.—No Manure	"	12·08	"
"	12 { 15 lbs. Concentrated Superphosphate / 60 lbs Nitrate of Soda ... ... }	"	14·27	"
"	13. { 15 lbs. Concentrated Superphosphate / 46 lbs. Sulphate of Ammonia ... }	"	13·84	"
"	14.—No Manure	"	11·19	"
"	15. { 39 lbs. Thomas Phosphate ... / 60 lbs. Nitrate of Soda ... ... }	"	14·27	"

In order to arrive at some answer as to the method of application giving the best results, the superphosphate this year has been drilled in with the crop; applied as a top dressing after the crop had come up, and ploughed in before sowing the crop. The after application had to be left in the hands of the farmer to carry out; and it is hoped he will have taken the little extra trouble incurred.

Wheat Varieties.

In addition to the manure tests with cereals, a very large number of wheat varieties was sent out to the farmers experimenting, and it is hoped that some information might be available as to the suitability of many of these varieties for special districts. In each case the variety generally grown in the district has been sown side by side with the introduced variety; and the farmer will be in a position himself to readily recognise any superiority in yield, &c., which the introduced variety may possess over the one he has cultivated himself. These plots were the $\frac{1}{10}$th of an acre in size, and were so arranged that each farmer might have at least seven varieties to experiment with. The total number of varieties at our disposal was a fairly extensive one, and we have to thank the Agricultural Department of New South Wales; Mr. Pye, of Dookie; Mr. McAlpine, of our Department: and Mr. Niven, of Longerenong, for kindly furnishing the seed.

The complete list embraced the following varieties:—

NAMES OF WHEAT VARIETIES GROWN ON EXPERIMENTAL PLOTS IN VICTORIA IN 1901.

FROM LONGERENONG.

1. Ward's Prolific Improved.
2. Sullivan's Early Prolific.
3. Queen's Jubilee.
4. Warland's Early Prolific.
5. Steer's Early Purple Straw.
6. Nut Cut.
7. White Lammas.

FROM MR. DOYLE, MELBOURNE.

8. Duluth.

FROM PORT FAIRY.

9. Queen's Jubilee.
10. Smith's Nonpareil.
11. Rarraf.
12. Farmer's Friend.
13. Dart's Imperial.

FROM MR. HASTINGS, SWAN HILL.

14. Victorian, Ward's.

FROM WAGGA WAGGA, N.S.W.

15. Steinwedel.
16. Red Straw.
17. Farmer's Friend.
18. Jade.
19. Nut Cut.
20. Steinlee.
21. Hudson's Early Purple Straw.
22. Australian Talavera.
23. Algerian.
24. Berthond.

FROM WAGGA WAGGA, N.S.W.—*continued.*

25. Nonpareil.
26. Tardent's Blue.
27. Marshall's No. 3.
28. Lambrigg White Lammas.

FROM DOOKIE.

29. Ranji B.D.
30. Ranji W.
31. Outpost D.
32. Improved Steinwedel D.
33. Purple Steinlee.
34. Jade D.
35. Straightvote D.
36. L.W.L. 99 C.
37. Steinlee B.D.
38. Hermit D.
39. Early Baart.
40. Austenlee D.
41. 51 K 99 C.
42. Allora Spring D.
43. Fountlee D.
44. Nhill D.
45. Kirby D.
46. Maffra D.
47. Rattling Jack.
48. Steinlee A.D.
49. Queen's Jubilee D.
50. Steer's Early Purple Straw.
51. Nut Cut D.

NAMES OF WHEAT VARIETIES, ETC.—*continued.*

FROM DOOKIE—*continued.*

52. Battleaxe D.
53. P.S. No. 1 B.
54. Bluestein.
55. Budd's Early.
56. Marshall's No. 3.
57. P.S. No. 5 B.
58. Defiance Purple.
59. Purple Straw Tuscan.
60. Frame's Early.
61. Comeback.
62. Mediah.
63. Sicilian Baart.
64. Pugh's R.R.
65. Egyptian C 2.
66. Australian Poulard.

FROM DOOKIE—*continued.*

67. Bancroft.
68. Mica.
69. Paros.
70. Fiorin.
71. Leak Rigg.
72. Leak's R.R.

FROM WAITCHIE, SWAN HILL.

73. Improved Allora Spring.
74. Steinlee.
75. Mentor.
76. Budd's Early.
77. Outpost.
78. Belatourka.

In addition to the smaller plots of seven varieties referred to above, there were two large fields where the whole of the varieties included in the above list have been tested on the single farm. One of these fields was established at the Longerenong College, and the other at Mr. Petering's farm, at Minyip.

Experimental Fields in the Central, Southern, and Western Districts.

A better rainfall, and more favorable climatic conditions generally, have allowed of far heavier dressings of manure in the experimental fields of these parts of the State than in our drier wheat-growing areas; although it must not be assumed by the farmer that, applications anything like so heavy or complete as these will be finally found to be necessary. Such heavy as well as complete manure dressings are used as an experiment only to discover the limits of profitable manuring and to find out soil deficiencies. It is hardly to be supposed that, with the heavier crops and altered climatic conditions of the western and southern districts, a continuous use of phosphatic manure only on the ordinary soil will prove sufficient for any great length of time. Although an answer even to this question can only be given by the test field repeated over a number of years. The crops experimented on in these portions of the State have been naturally more varied in kind than in the northern areas, and, as reference to the list in the early part of this article will show, they include wheat, oats, barley, potatoes, grass, chicory, lucerne, rape, mangolds, peas, flax, hops, lupines, maize, &c.

The following is a list of the heavier manure applications given to some of the crops in the western and eastern district :—

TREATMENT OF EXPERIMENTAL MANURE PLOTS.

The plots receive the following quantities of manure per acre:—

Plot 1. {
1 cwt. Ordinary Superphosphate.
1 cwt. Sulphate of Ammonia.
½ cwt. Potash Chloride.
}

Treatment of Experimental Manure Plots—*continued.*

Plot 2.—No Manure.

" 3. { 2 cwt. Ordinary Superphosphate.
2 cwt. Sulphate of Ammonia.
$\frac{2}{3}$ cwt. Potash Chloride. }

" 4. { 3 cwt. Ordinary Superphosphate.
3 cwt. Sulphate of Ammonia.
1 cwt. Potash Chloride. }

" 5.—No Manure.

" 6. { 2 cwt. Ordinary Superphosphate.
$\frac{2}{3}$ cwt. Potash Chloride. }

" 7. { 2 cwt. Sulphate of Ammonia.
$\frac{2}{3}$ cwt. Potash Chloride. }

" 8.—No Manure.

" 9. { 2 cwt. Ordinary Superphosphate.
2 cwt. Sulphate of Ammonia. }

" 10. { 2 cwt Ordinary Superphosphate.
1 cwt. Sulphate of Ammonia. }

" 11.—No Manure.

" 12. { 147 lbs. Nitrate of Soda.
2 cwt. Thomas Phosphate. }

" 13.—2 cwt. Bonedust.

" 14.—No Manure.

" 15.—2 cwt. Ordinary Superphosphate.

Experiments in Beet Manuring and Cultivation.

Special efforts have been made to give the question of beet manuring and growing the attention it deserves, and a number of plots have been established, not only on the grounds of the Maffra factory and the farms immediately surrounding, but in other parts of Gippsland. It is expected that the work of the sugar analysis of the early-sown crops will commence some time during February. It is possible that a detailed account of the beet plots may be given in a special article.

Fruit Manuring.

There were 49 fruit manure sets sent out to different orchards of the State last year. The successful use of manures on the farms throughout the country has suggested to the fruit-grower the possibility of a similar increase in the returns of the orchard by the application of a suitable fertilizer, and there is a growing inquiry for information on the subject. But I would repeat here, what I have frequently stated before, that the problem of fruit-manuring cannot be settled in one year, or in two years, and that it is wrong to expect immediate results. There is a good deal of trouble involved on the part of the fruit-grower in taking the weight of each separate tree, and where this is accurately done the thanks of the Department are certainly due.

Cultivation Plots.

A set of plots of a larger area, embracing some 10 acres in the whole field, was marked out in five different parts of the northern portion of the State. The plan will explain their object

Plan of Proposed Experimental Cultivation Plots

At Mr. ....

	Plot	Manure	Cultivation
		BORDER PLOT	
Cropped Continuously for 6 Years	Plot 1	50 lbs. Ordinary Superphosphate	
	2	No Manure	
	3	75 lbs. Ordinary Superphosphate	
	4	58 lbs. Thomas Phosphate	
	5	No Manure	
	6	50 lbs Ordinary Superphosphate, and 48 lbs Sulphate of Ammonia	
		BORDER PLOT	
		BORDER PLOT	
Cropped and Fallowed in Alternate Years	7	50 lbs Ordinary Superphosphate	Early Fallow and Frequent Cultivation
	8	No Manure	
	9	75 lbs Ordinary Superphosphate	
	10	58 lbs Thomas Phosphate	
	11	No Manure	
	12	50 lbs Ordinary Superphosphate, and 48 lbs Sulphate of Ammonia	
	13	No Manure	Late Fallow and Frequent Cultivation
	14	50 lbs Ordinary Superphosphate	Early Fallow but no Cultivation
	15	No Manure	
	16	50 lbs Ordinary Superphosphate	Early Fallow and Frequent Cultivation
	17	No Manure	
	18	50 lbs Ordinary Superphosphate	Early Fallow, Deep Stirring, and Frequent Cultivation
	19	No Manure	
	20	50 lbs Ordinary Superphosphate	Early Fallow, Frequent Cultivation, and Horse hoeing the crop
	21	No Manure	
	22	50 lbs Ordinary Superphosphate	Early Fallow, Frequent Cultivation
	23	No Manure	
	24	50 lbs Ordinary Superphosphate	
		BORDER PLOT	
		BORDER PLOT	
Cropped, Grazed, Fallowed in Successive Years	25	50 lbs Ordinary Superphosphate	Early Fallow, Frequent Cultivation
	26	No Manure	
	27	58 lbs Thomas Phosphate	

The first five plots are to be continuously manured and cropped from the commencement of the experiment. The returns in this case ought to give evidence of the continuous good effects or otherwise of a purely phosphatic manure as well as the results following a combination of a phospatic with a nitrogenous fertilizer. They will also show the comparative results of a superphosphate and Thomas phosphate, not for the one year only, but over a period of time. While the comparative returns of the annual application of 50 lbs. with 75 lbs. of superphosphate ought to give some key to the safe and most profitable quantity of a phosphatic manure to give annually in our drier areas. In plots 7 to 24 the system of continuous cropping adopted in the first six plots is to give place to one of alternate fallowing and cropping; while the various plots, as shown on the right side of the plan in this system, are to be subjected to great difference of treatment, and made to serve a number of valuable purposes. There is the early fallow, compared with the late fallow, both with frequent summer cultivation. There is the early fallow with and without cultivation. There are subsoiled plots and plots where the growing crop is to be horse-hoed. I am aware that the benefit of the bare fallow in a dry district is generally admitted, and that the necessity of an early and frequently-worked fallow is also pretty freely recognised; but it will prove of interest to learn to what extent the bare fallow will carry its advantages now that the artificial manures may be used on the stubble. On plots 25, 26 and 27 the ground is to be cropped, grazed and fallowed in successive years. If continued over a sufficiently long time such a set of experiments ought to give a good deal of information as to the increased yields that may follow the use of manure under the three different systems of cropping pretty general over a large portion of our State. The plots in these larger fields were marked out, and simply served the purpose of a manure test last year. The experiment proper will commence in the present year. The value of such experiments will depend upon the continued interest, over a number of years, of the gentlemen who have kindly undertaken them. These plots are situated on the farms of Mr. Cobham, Waitchie; Mr. McPherson, Wycheproof; Mr. Mortimer, Katunga; Mr. Gawith, Jeparit; as also at the Longerenong Farm.

Experiments on the Waste Lands of the State.

A commencement has been made in this direction in the Little Desert, Dimboola. The soil here is almost a pure sand of an exceedingly poor nature. About 2 acres have been cleared and put down in fruit trees, vines, grasses and fodder plants. All these naturally have been manured, but owing to delays were got in a good deal too late. Half the cost for establishing the field has been met by the Dimboola Shire Council, and Councillor McLennan has arranged to look after the plots. The land is generally recognised locally as too poor for the growth of any agricultural crop, but manures have provided such startling results on soils of very little better quality that the test is well worth making.

Concluding Remarks.

It will be admitted from the foregoing that a rather extensive system of co-operative experimenting has grown up in the country, and has in a certain measure met a want that can only be properly supplied by a number of properly-equipped stations, for it is not to be expected that these farm experiments, carried out under intermittent supervision, and for the most part by the unremunerated labour of the farmer himself, should be asked to compare with the standard of an institution under constant departmental control; but they have answered, and, even after the establishment of such institutions, will continue to answer, a great educational purpose for the farmer; and should the actual returns in figures from them not amount to more than one-tenth per cent. of their number, the lesson in no single instance will have been lost, for the demonstration will have come under the eyes of the farmer, and have been brought under the notice of his immediate neighbours, and in the following year, instead of one man only adopting the teaching, a dozen or more probably will have come under its influence.

DAIRYING BRANCH.

DAIRYING IN EUROPE.

A Report to the Honorable the Minister of Agriculture, by T. Cherry, M.D., M.S., Lecturer in Bacteriology, Melbourne University.

25th June, 1900.

On the 18th July, 1899, I received a letter from the Secretary of Agriculture authorizing me to inquire into various matters connected with the dairying industry during my visit to Europe. On arrival at Marseilles I went to Switzerland, Paris, and London, where I placed myself in communication with the Agent-General and with Mr. Sinclair. From London I proceeded to Belgium, Holland, North Germany, Denmark, and Sweden. I spent November, December, and part of January in England, and returned to Marseilles by way of Northern France and the Rhine.

I.—Milk Supply.

Much attention is now devoted in all the progressive countries of Europe to the question of a pure milk supply. The methods adopted may be conveniently described under the two heads of the inspection of the dairy herds, and the handling of the milk.

The Inspection of the Dairy Herds.

This has to do with the two points of the cleanliness and general management of the herds and milking sheds, and the inspection for the presence of disease likely to be transmitted to the consumers of the milk. The two diseases specially to be guarded against are tuberculosis and typhoid fever. In tuberculosis the danger arises from the cows which are suffering from the disease, especially when the udder is affected. The germs come direct from the diseased parts of the cow. In typhoid fever the danger is in the dirty management of the milk farm. There is no evidence to show that when the typhoid germs happen to be present in water drunk by the cow, they ever find their way to the udder, and are secreted with the milk. The danger lurks in two places: 1st, the cows may lie on ground polluted with typhoid excreta, and the contaminated dust from their hair fall into the pails during milking; or, 2nd, water contaminated with typhoid bacilli may be used for washing the cows and other utensils.

A. With regard to the detection of tuberculosis, in Germany, Denmark, and Sweden, absolute reliance is now placed upon the tuberculin test. Tuberculin is a chemical substance produced by the tubercle bacilli in the course of their growth. It may be likened to the alcohol produced by the yeast plants in the course of their growth. Tuberculin differs from all other known substances in the fact that a minute dose of it injected under the skin, has a very marked effect upon animals which are affected with tuberculosis. The temperature of tuberculous animals begins to rise a few hours after the injection, and after remaining several degrees above normal for a varying time, it begins slowly to fall again. The fever so produced is called the "re-action." Cattle which are not tuberculous, do not "re-act" at all, the dose of tuberculin apparently having no effect upon them whatever. It is recognised that the "amount of re-action," or, in other words, the degree of fever produced by the injection of the tuberculin, bears no proportion to the extent of the disease. Thus a cow with slight disease, perhaps with not more than one or two of the lymphatic glands (kernels) tuberculous, and in all other respects in perfect condition, may re-act strongly. Another, in the last stages of disease, may scarcely re-act at all. Reliable statistics show that the tuberculin test fails in less than 5 per cent. of the animals examined. Its greatest value lies in the fact that the early stages of the disease are thus detected when they can be discovered by no other known method. When a cow has re-acted she is not necessarily slaughtered at once, unless the udder is affected. The method adopted is to divide the herd into two parts, the one consisting of the animals which do not re-act, and are therefore free of tubercle, the other of those which react, and are therefore tuberculous. The two parts of the herd are not allowed in any way to mix, but are kept in separate paddocks, byres, and milking sheds. The object of the owner is, of course, to gradually get rid of the reacting part as quickly and with as little financial loss as possible. Cows with affected udders are slaughtered at once; those that will fatten are got into condition and then slaughtered, the meat being examined by an official inspector, and allowed to pass into the market if the animal is only slightly affected. In the case of specially valuable cows, they may be kept for breeding purposes for several years after they are known to be tuberculous, but generally speaking, it is more profitable to kill them at the first favorable opportunity. The milk from the tuberculous part of the herd is always separated and pasteurized, the sediment or slime left on the walls of the separator being carefully burnt. The calves of these cows are brought up by hand, on pasteurized milk, by means of an artificial udder, or can with an indiarubber teat. If skim milk is used, linseed, or an equivalent, is added to replace the cream. If the artificial udder is always sterilized* after use, and the calves fed on freshly pasteurized milk, scouring is prevented, and there is no difficulty in rearing healthy animals. As soon as they are old enough to turn out, they are tested with tuberculin. It is almost invariably found that they are free of the disease, tuberculosis being inherited only in the most exceptional cases.

* In *sterilizing* a boiling temperature has to be employed, in *pasteurizing* a temperature of 160° F.

TUBERCULOSIS IN DENMARK.

TABLE showing the results of the Tuberculosis Test as applied to the whole of the Dairy Cattle in Denmark.

District.	Number of Herds.	Number of Cattle.		Percentage.		Age of Cattle.							
						Under 1 Year.		Under 2 Years.		Under 2½ Years.		Over 2½ Years.	
		Sound.	Reacting.	Sound.	Reacting.	Sound.	Reacting.	Sound.	Reacting.	Sound.	Reacting.	Sound.	Reacting.
Jutland	2,721	43,479	23,311	65·1	34·9	9,739	1,471	11,717	4,139	6,492	3,776	15,891	13,925
Fyen	1,355	22,770	7,302	75·7	24·3	4,005	334	5,478	1,098	2,997	1,217	10,290	4,653
Zeeland	662	13,026	9,903	56·8	43·2	3,159	610	3,382	1,589	1,988	1,419	4,497	6,285
Moen	82	1,313	629	67·6	32·4	260	33	259	88	226	104	568	404
Lolland-Falster ...	198	6,248	2,497	71·5	28·5	1,284	146	1,622	397	831	371	2,511	1,583
Bornholm	588	12,065	2,257	84·2	15·8	1,664	87	2,763	385	1,864	408	5,774	1,377
Total	5,306	98,901	45,899	68·3	31·7	19,751	2,681	25,221	7,696	14,398	7,295	39,531	28,227
		144,800				88·1%	11·9%	76·6%	23·4%	66·4%	33·6%	58·3%	41·6%

The following synopsis of the law in Denmark respecting the use of tuberculin, and the measures taken against tuberculosis, will show the extent to which this disease has been brought under Government control :—

1. A sum of £5,500 shall be annually placed on the Estimates of the Minister of Agriculture for the assistance of those proprietors who wish to use tuberculin as a diagnostic means of fighting tuberculosis amongst their stock. The tuberculin test shall be used on the cattle in accordance with rules fixed by the Minister. Payment shall only be made to those owners who undertake to keep the animals which fail to re-act to the tuberculin separated in a satisfactory way from those which have re-acted or which have not yet been tested.
2. At the option of the Minister part of the said sum may be used for rendering assistance to agricultural associations for the purpose of making systematic tests with tuberculin with the view of determining its value in the diagnosis of the disease.
3. Owners of stock who do not carry out the obligations undertaken by them as to the separation of the herds, shall be compelled to refund any payments already received.
4. Applications for assistance from farmers may be forwarded to the Minister through the agricultural associations.
5. The importation of foreign cattle shall take place only at ports fixed by the Minister. Such cattle shall at once be placed in quarantine, and be tested with tuberculin within five days. After the test the animals which have not re-acted shall be placed at the disposal of the owner. Those which have re-acted shall either be sent back to the port from which they came, or else be taken direct to a public abattoir, where they shall be slaughtered under the control of a veterinary inspector.
6. The cost of establishing the quarantine stations and of applying the tuberculin tests shall be borne by the State ; all other expenses by the importer.
7. In the case of imported cattle the quarantine and the tuberculin test may be omitted if the cattle are slaughtered within ten days, provided that during this time they remain constantly under the control of a public veterinary inspector while being moved about the country.
8. Cows affected with tuberculosis of the udder shall be killed in a public abattoir under official inspection. In compensation for the slaughtered animal the proprietor shall receive a sum equal to one-quarter of its value as dead meat, fixed at current market price. Moreover, for the part of the meat declared by the inspector to be unfit for human consumption the owner shall receive

compensation to the amount of one-half its value at current market rates. The part declared fit for human consumption is placed at the disposal of the owner. The compensation is paid by the State.

9. After 1st June, 1899, dairies are forbidden to deliver for animal's food milk and buttermilk which has not been heated to 85° C (185° Fahrenheit). Exception to this clause will be made if the heating is prevented by an unforeseen accident, in which case the person receiving the milk must be notified of the fact. In cleaning the centrifuge, the slime adhering to the machine must be burnt.

10. Milk and buttermilk must not be imported from abroad unless the Minister is satisfied that they have been thus treated. In special cases the Minister may temporarily suspend this clause.

11. The enforcing of the provisions of this law shall be in the hands of the veterinary inspectors, the Customs officials, and the inspectors of factories acting under instructions from the Minister of Agriculture.

12. Penalties for infringement range from 10s. to £10. Milk seized for not having been pasteurized is confiscated, and after being properly pasteurized, it is sold, and the proceeds go to the State.

13. This law came into force in 1898, except par. 9. Suggestions for its amendment may be presented to the Rigsdag before the end of the year 1902.

Tuberculosis in cattle is a subject which deserves much more attention than it has hitherto received in Victoria. No reliable statistics are available as to its prevalence among our dairy cattle. At the City Abattoirs, Melbourne, between 3 and 4 per cent. of the animals slaughtered are tuberculous, but as most of these are young bullocks, no inference can be drawn as to the proportion of the dairy cows affected. The average number of deaths from tuberculous diseases in children under the age of ten years is about 300 per annum in Victoria, and the vast majority of these are generally assumed to be due to the drinking of unsterilized tuberculous milk. But apart from the public health point of view, there is the direct loss to the farmer in keeping cows which are generally to be classed as "wasters," and the danger to the export trade in butter if tubercle bacilli were ever discovered in our produce. Steps should therefore at once be taken to ascertain the extent to which the disease is present in our dairy herds, and the use of tuberculin renders this comparatively easy, and with due care the results attained would be quite reliable.

B. With regard to typhoid fever, I have already said that the danger lies in the management of the dairy farm. So far as is known none of the lower animals are liable to attacks of this disease. The germs, therefore, are not given out from the udder with the milk in the

same way as the tubercle bacilli are. On the other hand, they are introduced into the milk either with particles of dirt from the hair of the cows, or else with the water in use for washing the utensils. The safeguards are to be found in an efficient system of inspection of the farms, and in the adoption of the improved methods of handling the milk, and cleansing all utensils, which will be described in the next section. The inspection should have to do (1) with the dairy itself, and (2) with the relationship of the farm to the drainage of neighbouring townships. The evidence of recent scientific work goes to show that the typhoid germs are not easily destroyed after they have left the body of the patient. Hence they may be carried for long distances down a creek, and become a danger to people who have never been near the sick person. Many outbreaks of the disease in connexion with contaminated water have been traced in this way to a distant source. *In the case of milk there is the further danger that any germs* which get into it will rapidly multiply, even in cool weather. So that, given the same amount of contamination of, say, a gallon of milk and a gallon of water, the former is much the more likely to spread the disease. Typhoid germs are killed by pasteurizing any fluid, and this is one important consideration which should lead us to treat all milk in this way. The following extract from my report to the Royal Commission on Technical Education will show the importance of this question :—"Throughout Victoria typhoid fever is the one disease which robs the country of the young adults with unvarying regularity. At present the deaths number about 340 per annum. In 1898 they rose to 557. If we could bring the death-rate down to the English figures (157 per million) there would be a saving of nearly 200 lives a year." Contaminated water and milk are two of the well-recognised ways in which this disease is spread.

2. The Handling of the Milk.

The deterioration of milk as an article of food is due to the fermentation set up by micro-organisms growing in it. When this growth has gone on to a certain point the milk becomes sour ; if it continues further the milk first clots, and then decomposes. Sour milk is not of itself necessarily unhealthy, but side by side with the growth of the germs which cause the souring, any others which may have found their way into the milk will also go on growing and multiplying. Among these it occasionally happens that germs are present which are able to set up digestive troubles. Young calves and young children are alike liable to suffer from a sour-milk diet. In Victoria, of every 100 children born, the number which die during the first year is 16 in the towns, and 10 in the country districts. The chief cause of this difference is found in the milk supply ; it is stale in the towns, and fresh in the country. The growth of the germs of all kinds is checked by a low temperature ; hence the milk supply is much more satisfactory in the winter than in summer. The period during which any sample of milk may be kept sweet may be greatly lengthened by the adoption of clean methods of milking, that is, by reducing the number of germs in the milk to the lowest possible

number. The use of the separator is also a most valuable way of getting rid of most of them, as it is found that the deposit on the walls of the machine contains nearly all the micro-organisms in the milk. The little particles of dung adhering to the udder are the source of most of the contamination, and those, of course, can be almost entirely kept out of the milk by care in the milking. The following table * shows the influence of time and temperature on the multiplication of germs in milk. The numbers calculated are those in 1 cubic centimetre (about twenty drops).

On arrival at the laboratory (two and a half hours after milking) the number present was 9,300.

Time the Sample was kept.	Temperature at which the Sample was kept.		
	59° F.	77° F.	95° F.
3 hours	10,000	18,000	30,000
6 ,, ...	25,000	172,000	12,000,000
9 ,, ...	46,500	1,000,000	35,000,000
24 ,, ...	5,700,000	577,500,000	50,000,000

It will be seen that at ordinary temperatures multiplication is slow at first, and becomes rapid as the numbers increase. At high temperatures, on the other hand, the multiplication is very rapid at first, and then proceeds more slowly. When the taste of milk changes to sour, it usually contains about ten million organisms per cubic centimeter. The first requirement, with regard to the handling of milk, whether it is to be supplied fresh, or pasteurized, or sent to the butter factory, is to reduce the initial number of micro-organisms to a minimum by care in the milking. All subsequent difficulties are thereby reduced in a corresponding degree. Cleanly methods of milking can only be secured by a process of gradual education. Children should not only be told and shown how to do it, but they must find out the reasons for it for themselves. The general principles of fermentation might easily be introduced as part of a course of experimental science in the State schools.

Two methods are in use by which the growth and multiplication of the germs are checked, and the milk is delivered to the city customer in practically a fresh state. The first is by pasteurization, the second by freezing. The details of the former method are familiar to all. It destroys 997 out of every 1,000 organisms present. The comparatively few that are left are unable to multiply to any important extent under 48 hours. Pasteurization, with rapid cooling and storage in bottles, which have also been properly sterilized, therefore enables milk to remain fresh for an average of two or three days, The exact time will depend on the temperature at which the bottle has been kept. Frozen methods are making great headway in northern Europe. In the Copenhagen Pure Milk Supply Co., the milk is pasteurized at the farms and then sent by rail to the central works in the suburb of Fredericksberg. It is at once weighed, tasted, tested for its cream value, filtered

* From von Freudenrich.

through sterilized sand, and then bottled by special machinery. The bottles are then sealed and dated, and sent round by carts to the consumers. This company only receives milk from farms which have at least 100 cows. Each farm has a pasteurizing and cooling plant. The cows are all examined by the company's veterinary inspector twice a month, and a sanitary inspector in the company's employment is constantly going round to keep the farmers up to the mark as regards cleanliness, and the general management of the farm. Another large company in Copenhagen adopts the frozen method on what is called Casse's system. In the country at the large farm, or factory, the milk is pasteurized, and then frozen while perfectly fresh. It is forwarded every evening to the central works in Copenhagen. It arrives frozen hard, and is thawed with constant agitation, so as to evenly distribute the frozen cream. It is then filled into bottles by machinery similar to that mentioned above. The bottles have a paraffined stopper stamped with the date and reference number. The milk begins to arrive by rail at about 10 p.m., and the work goes on till all the carts are ready to begin delivering it at about 4 a.m. As the milk is just thawed at the time it is bottled, the consumer receives it at about the same temperature even in summer. It will, therefore, be seen that this milk—pasteurized first and then frozen—is in the best possible condition for keeping. I visited the works of companies supplying milk on methods similar to those in Stockholm and Berlin. That in Berlin (Bolle Company) supplies fourteen varieties of milk at prices from 1½d. to 8d. per quart. It is said that nearly half the milk supply of Berlin is in the hands of this company.

(*To be continued.*)

THE COMPOSITION OF MILK AND ITS PHYSICAL CHARACTERISTICS.

By H. W. Potts.

The first of a series of Lectures, with demonstrations, given to State School Teachers attending the Summer School, Training College, Melbourne, January, 1902.

In formulating and arranging these lectures I desire at the outset to clearly define their purpose. It is not intended that they shall be accepted as an iron-bound scheme of lessons to provide methods for daily teaching.

The primary object is to lay down principles and point out facts, from which the teacher may derive enough material to prepare and organize attractive lessons for country children, useful in their application to rural life, and in strict keeping with the precepts of modern teaching.

The chief aim is to develop the reasoning faculties with sympathetic feeling, largely assisted by demonstration and example. To convey to the child's mind unassailable truths. The final object being to inspire a love for rural work by making the pupil understand it.

It is possible, at that impressionable period, to create confidence in and affection for country life, as against the ever present wish to follow city pursuits.

A duty devolves on teachers to impress the young mind that life on the land is the most independent of all; furthermore, it may, with intelligence, enterprise, and application be rendered the most remunerative.

The success of this effort, to fit in elementary education to the environment of the children, mainly depends on the teachers and their adoption of methods to be addressed less to memory than to intelligence. To plan each lesson and demonstration so that the child may aptly perceive the reason for such, and to foster a sense of confidence and individuality.

In the dairying districts teachers are brought into daily association with children who are engaged in milking, and performing other duties on the farm. It is within their power, by such aids as are outlined in this course of lectures, to render the prosaic occupation of dairying less drearisome and more attractive; and to correct the inclination in the children's minds that literary or clerical avocations are more dignified.

Teachers are charged with a weighty responsibility in framing the ideals of an important industrial class. These, if properly directed, must result in giving a lasting stimulus to one of our greatest national industries.

Milk.

Milk appears to be a homogeneous fluid, ranging in colour from yellowish white to a faint blue, opalescent in hue, sweet and agreeable to the palate, soft and greasy to the touch, with a faint, but not unpleasant, animal odour. It may be likened to a mixture of chalk and water. When dropped on to tissue paper, or spilled over a boy's tweed trousers, or a girl's winsey frock, it leaves a greasy stain, demonstrating the presence of fat.

For the development of young life, either animal or human, milk is a perfect food. In it are found all the elements required to stimulate and furnish the growth of flesh, muscle, bone, skin, hair, and tissue.

It will be noted that such claim is confined to young life. The total amount of nutritive solids in a pint of milk is 2½ ozs., and to provide enough nourishment per day for a full-grown man 23 ozs. would be required, or 9 pints of milk; hence such a diet, to say the least of it, would be inconvenient.

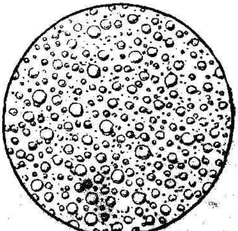
One pound of beef contains about the same proportion of nutritive constituents as a quart of fresh milk.

The class of milk we propose to discuss in these lectures is that taken from the cow. This animal originally only gave enough milk to feed her offspring; but, as a result of domestication, with special selection, breeding, feeding, and intelligent care, the milking habit has been artificially developed to such an extent that a large surplus is now yielded, and this is used as a universal food in a variety of forms as milk, or butter and cheese, and other products of milk.

Physical Changes.

Milk is subject to several changes. The first to be observed, when it is allowed to stand, is the accumulation of cream on the surface.

A microscopic examination shows milk to contain an innumerable quantity of oil-fat globules or cells. These spherical bodies are so small that a drop of milk has been estimated to contain one and a half millions.



Microscopic Appearance of Milk.

It was supposed that each cell was kept intact by means of an albumenoid envelope or skin. This, however, has been disproved. The fat globule seems to be maintained by being completely surrounded with the serum of the milk. Oil being lighter than water, these fatty particles rise to the surface, coalesce, and form cream.

When milk has been allowed to stand for some time the sweetish taste gradually disappears, and is replaced with an increasingly sour or acid flavour. This is readily detected, not only by the senses of taste and smell, but also by the use of litmus paper. On immersing a leaf of the latter the blue colour fades out

and a red hue is imparted. At first this is only faintly discernible. This, however, becomes more pronounced and deeper as the souring process increases.

Later on the maximum of acidity is reached, and the milk separates into curds and whey. The coagulation or change in this instance is solely due to organic invasions or bacteria. This will be fully explained in the succeeding lecture.

There is another form of coagulation brought about by the introduction of dead or inorganic ferments, such as rennet, or the addition of weak mineral acids, vinegar or lime juice. The action of rennet in coagulating milk is seen in the well-known culinary operation of making junket by means of rennet tablets.

To enable us to investigate these and other changes milk and its products are subjected to, and, further, to intelligently elucidate many problems relating to the successful prosecution of dairying, it is necessary to ascertain the chemical composition of milk. To that end it is here proposed to demonstrate a simple form of approximate analysis.

Composition of Milk.

Milk varies in character and quality under all sorts of conditions, and such variations are largely determined by the breed of the cow, her age, state of health, class of food, period of lactation, care, treatment, and other factors too numerous to mention. Hence the analysis submitted here must only be considered from a general average stand-point.

For the purposes of familiar and simple illustration the ordinary milk-can used at our farms daily to convey milk to the creamery or factory will be employed, *vide* Figs. 1 and 2. Each can holds 10 gallons, and should distilled water be used it will weigh 100 lbs. Milk contains other matter in the form of solids and fat in solution and suspension, and a tank holding 100 gallons of pure water at a temperature of 60 deg. F. will weigh exactly 1,000 lbs., but if you replace the water with milk it will be found that the weight will range from 1,028 lbs. to 1,033 lbs., according to the sample used at a similar temperature. This is known as the specific gravity.

For the purposes of illustration we may now take the 10-gallon milk-can and weigh carefully into it 100 lbs. of milk.

We know that milk is largely composed of water, and this can be evaporated by heat. The milk-can is placed on a stove, and heated until all the water is driven off. When cool the can is re-weighed, and a shortage found of 87 lbs. In the bottom of the can will be discovered a greasy yellowish mass. We have now the first determination of water and solids. The water weighs 87 lbs., or nearly 9 gallons by measurement, and the solids 13 lbs. (Fig. 2.) At this stage the children's attention should be directed to the large proportion of water found in milk, and the importance of cows having access to an ample supply of pure water. The water in the milk is secured by the cow from the moisture in the food she consumes, and the water made available for her to drink. If these be restricted in any degree, then

FIGS. 1 AND 2.—MILK CANS.

a shortage in the milk yield must result. It is also necessary to point out that clean pure water is essential; a contaminated or impure supply lowers the character of the milk. The solids are derived from the food the animal eats—such as grass, hay, bran, chaff, and other fodders. The flavour and condition of milk, butter, and cheese are affected by unsuitable or tainted food, coarse rank herbage, turnips, cape weed, may weed, &c.

To secure the highest quality in dairy products, cows should be provided with good water, and sound, wholesome, nutritious, and palatable food.

The Solids.

These are usually divided into two classes—fatty and non-fatty.

Commercially the fatty solids are of the first importance. Butter-fat is the most variable constituent in milk, whilst the non-fatty solids are fairly constant. The breed of the cow chiefly determines the fatty contents. For example, the Jersey will persistently give milk showing a yield of butter-fat ranging from 4·5 per cent. to 5 per cent., and often as high as 6 per cent., whereas the Holsteins or shorthorns range in the neighbourhood of 3·6 per cent. The Guernsey also gives very rich milk. The Ayrshire will average 3·8 per cent. Even then it is found that individual cows will give a low return of butter-fat. The knowledge of the butter-fat contents aids the dairyman to select the most profitable cows.

In several dairying countries an average of 3·6 per cent. butter-fat is recognised as satisfactory; but in Victoria we possess large numbers of herds which will average 4 per cent. We deem it advisable to indicate a high standard, and hence in our illustration we nominate a 4 per cent. return.

By a chemical process the butter-fat is extracted from the 13 lbs. of solids found in the milk-can and weighed at 4 lbs., or 4 per cent., leaving a residue of 9 lbs. to be accounted for.

Here it is advisable that the children's attention should be especially drawn to the fact that so far we have discussed pure butter-fat or oil. This forms the basis of commercial butter, and amounts to about 85 per cent. To this is added moisture, curd, a small proportion of mineral ash, and salt to make the butter of daily use in our households.

This requires to be made clear to the pupils, as the question of testing for butter-fat will be dealt with in a subsequent lecture.

Milk Sugar

Is the sweet principle found in the milk of all animals. It is isolated and identified by evaporating whey, in which it is held in solution, and allowed to crystallize. From a chemical point of view, milk sugar or lactose is identical with cane sugar. In appearance the powdered varieties of each sugar are the same, but a difference is detectable in the taste; the milk sugar is not so sweet as the other, and further it is not so soluble in water. At this stage it will be advisable to send a sample of each around to the pupils to taste, so that they may identify the milk sugar.

This is the carbo-hydrate of the milk, the function of which, as a food, is to support animal heat and energy. It is very digestible, and forms an important feature in artificial foods for infants.

In the solids from 100 lbs. of milk, we find about 5 lbs. of milk sugar.

Casein and Albumen.

(Curd and the White of Egg.)

When curd is formed in milk we find it associated largely with albumen, or the white of egg. There are also several ferments ; but it is not our purpose to deal with the latter in this elementary course. We are interested in the curd from the fact that it forms with the butter-fat and some water the principal constituents of cheese. Curd or casein is easily precipitated or separated from the whey by means of rennet, or dilute acids, vinegar, or lemon juice. The albumen or white of egg is coagulated by heat, a temperature of 170 degrees F. being sufficient to effect this.

In the solids found in the can we find about 3¼ lbs. casein and albumen.

It may be worthy of note that well-made cheese contains a large proportion of nitrogenous matter, and hence is a valuable, nutritive, and economical food. When eaten with bread, as a food, it is twice the value of meat, and forms a highly nutritious diet for men engaged in manual labour.

Mineral Ash.

The indestructible residue found in the solids of milk, and known as the mineral ash, exerts a leading influence on the character of milk as a food. In it we find potash, soda, lime, magnesia, and iron, in combination with phosphoric, sulphuric, carbonic, and hydrochloric acids, the chief elements being lime, potash, and phosphoric acid. To these we are indebted for providing those mineral salts so essential in food in so far as these constituents provide the nutritive material for the general bone structure of the body, teeth, and other tissue. Without these salts and their compounds milk would fail to provide the requisite nourishment for the most important tissues in the body. The average quantity found in 100 lbs. of milk is 12 ounces.

To recapitulate, we find in the 100 lbs. of milk :—

Water	87	lbs.
Butter-fat	4	,,
Milk Sugar	5	,,
Casein and Albumen (curd and white of egg)	3¼	,,
Mineral Ash	¾	,,
	100	lbs.

To bring out the features prominent in the pupil's mind, a condensed form of essay should succeed each lesson, in which the illustrations on the blackboard ought to be reproduced. Further, the

space for recording an intelligent and consistent account of the leading phases of the subject should be defined, to cultivate conciseness and method in grouping facts.

The subject-matter of this lecture may, with advantage, be divided to provide two or more lessons.

The following materials for demonstrations should be available :—

Pure milk	Cheese
Sour milk	Butter
Curds and whey	Milk sugar
Tissue paper	Iceing sugar
Litmus	Vinegar
Hansen's Rennet Tablets	Tumblers, to show exhibits
Thermometer	

NEGLECTED CREAM PUMPS.

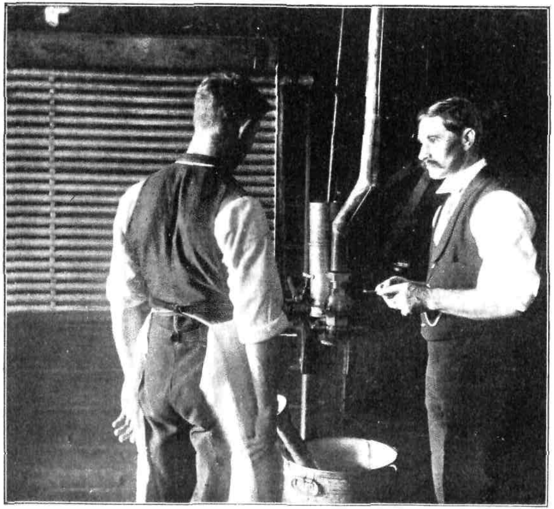
By R. T. Archer, Dairy Supervisor.

It is not an usual occurrence to find utensils, vats, or machinery in our factories in a dirty condition. Managers are properly impressed with the importance of paying studious attention to cleanliness in all its phases. They realize the need for setting a good example to their suppliers. Notwithstanding all their vigilance in this direction, it occasionally happens that an insidious form of invasion will assert itself in the manufactured product. One of these faults is detected by our graders at the export depôt, and is classed under the general term of "staleness." This condition is evidently the result of fermentative changes arising from several causes, more or less indefinite, and occasionally very difficult to trace to the initiative source. To arrive at this frequently means endless search, and always anxiety, to the manufacturer. Quite recently I was instructed to visit a butter factory, to locate and investigate the cause of a peculiar taint or false flavour in the butter forwarded for export, and classed by the graders as "stale."

A patient and thorough overhaul of the methods adopted in dealing with the raw material, both in temperatures, practice, and machinery, as followed up. Eventually the origin of the objectionable taint in the butter was discovered. A cursory examination of the cream pump led to a closer investigation. The pump was taken to pieces. On removing the plunger an accumulation of decomposed cream, the odour of which can be readily imagined, was found not only on the cup of the plunger, but adherent to every part. There could be no question about the infective activity of this putrid mass, and here was the cause for the false fermentations and subsequent "staleness" in the butter.

This is found to be a source of trouble in butter factories occasionally. For years past many of our managers have unhesitatingly condemned the use of the pump for elevating the cream from the separators to the vats. To avoid the pump is one of the advantages claimed by those who designed buildings to deal with milk on the gravitation principle. Where pumps are in use for cream there are two conditions subject to criticism —first, the possibility of cream collecting on the plunger, as well as in the chamber, and with insufficient attention to strict cleanliness, the adherent cream readily decomposes and acts as a contaminating medium; further, the adjustable pipes are long, clumsy to handle, and awkward to get thoroughly clean, even with a long brush. Secondly, we have the action, always present, of forcing air through the cream under pressure.

At a number of modern factories the pump has been abandoned for the more serviceable system of sending the cream in open cans to the cooler on the top floor by means of a hoist. It may entail more labour, but all the lurking mischief associated with pumps and pipes is done away with. The manager can watch all the conditions



A LESSON ON CLEANING A CREAM PUMP.

THE DAIRY SUPERVISOR CONDEMNING A RUSTY CAN.

surrounding the delivery of the cream in readily cleansed vessels, and the chances of contamination are avoided. The cream is collected direct from the separators by this means, and delivered to the cooler. Where creameries are used to feed the factories, then the cream cans are taken straight on to the hoist.

In many factories cream pumps are part of the equipment, and the suggestion to put in hoists is not feasible, then it is necessary to thoroughly grasp the idea that the cream pump may be a source of injury to the butter, and hence daily attention must be paid to cleansing it. The plan should be adopted of disconnecting and removing the plunger and piston daily. They must be thoroughly scrubbed and washed in a ½ per cent. boiling solution of washing soda. The effect of this is threefold—first, the alkaline action in saponifying the fat, thus rendering it soluble; second, in acting as a germicide and destroying all organisms, hostile or friendly; and, last, as a preventive of rust. Finally, all separate parts should be well steamed.

The pipes are undoubtedly the most troublesome to cleanse satisfactorily, and if left to careless employés, the results are constantly perceptible. It is in such operations as these that the manager's keen supervision is demanded.

Where neglected, and the leisurely habit followed of "taking things for granted," then the business of the factory is being conducted on very unsafe lines.

The warning note sounded by the Government Grader's report, the inevitable confirmation of this follows in lower market returns, and leads to a general "hustle up" after the mischief has become palpable. All operations in a butter factory are controlled by the manager. His influence permeates every section, phase, and corner of the factory and its functions. If he fails to exert such influence in the direction of discipline, regularity, and cleanliness, then the inevitable result must obtain of variation in prices for the butter.

SPAYING COWS.

By David Wilson.

Combined with strict attention to the first principles of breeding, viz., the use of pure sires on good cows, is the system by which all the leading cattle raisers in Australia, New Zealand, and Canada have kept up the standard and reputation of their herds. Every year, when the cattle were mustered for branding, they took from among the females all the scrubby sorts, bad colours, bad shapes, those that were not breeding satisfactorily, and aged cows they did not want again, *and had them spayed*. By this one act these cattle were cut off from the breeding herd, and got a fair start to their final destination—the meat market.

The advantage of spaying the culls or inferior, aged, or unprofitable dairy cows has long been recognised, but at no period in the history of cattle breeding in Victoria has the necessity been so apparent as now. The gain to the dairy farmer must be immense, and therefore the more general adoption of the system is a matter of the greatest importance to the welfare of the industry.

With the rapid growth of the dairying industry, and the consequent demand for milkers and springers, the tendency has been to get every cow and heifer in calf, so that they might be sold as milkers. *Every available animal has been bred from, irrespective of its butter-producing qualities*; and the sires used have been, in many instances, scrubby mongrels, without breeding or any other object, except that of perpetuating their kind. The result is plainly evident to any one attending the country sale-yards. It is almost impossible to buy a line of steers or heifers without getting along with them a large percentage of ill-shaped, bad-coloured, and under-sized cattle. The system of sending culled dairy cows into the markets to be sold as milkers or springers tends to depreciate the value of really good milkers, while it perpetuates the race of inferior dairy cows. The unfortunate buyer of these animals is saddled for the season with unprofitable dairying cows; and he, in turn, will put them on the market to be sold again. So the game goes on until age or death puts an end to these unprofitable ones. Even in the first place, if they are sold as stores for fattening purposes and not spayed, a large percentage of them, before they are fit for the butcher, prove in calf, and are sold again to the dairymen as springers.

With the increasing competition in the dairying industry, and the scarcity of good steers for fattening purposes, it is high time that every dairyman should pay attention to the class of cattle he is breeding and keeping, and aim to raise the standard of his herd with regard to butter production and general usefulness.

To show what room there is for improvement on the average profit-producing capabilities of the dairy herds of this State, it is only necessary to mention the competitions conducted during the past four years, and instituted by the proprietors of the *Leader* newspaper—the prize for which last year was won by Mr. Goldie, of Port Fairy.

His cash return per head per year for twenty-seven (27) cows was £14 8s. 6d. for milk alone, and, though numbers of dairymen in the western and other less favoured districts of Victoria are getting a return of £10 per head, yet the average return for the whole of the State is under £5.

There can be no question, therefore, that many dairymen are keeping in their herds cows that are not payable butter producers. These animals are *actually* eating up the profits of the good cows; they are *lowering* the cash return per head. They are making extra labour in milking, and are living on the food that would keep profitable cows.

The only way for dairymen to find out which is their profitable cows is to have the milk of each cow weighed during the season at intervals; have each individual cow's milk tested by the Babcock test; keep a book with the records of the weight of the milk of each cow; and the average test of her butter fat, and he will soon find out whether the cow is profitable to keep or not. When a cow is proved to be unprofitable for butter producing, *spay* her; and thus protect the dairying industry by making sure that she will go to her proper destination—the meat market. The testing of each individual cow by the aid of the Babcock test and the milk scales is the exception, and not the rule, so far in Victoria, *but it will have to become general.* The progressive dairymen that have taken it up are, by its assistance, rapidly culling their herds and raising their profits per head. It is a proved fact that without individual testing with the aid of the milk scales and Babcock test, or churn, that it is impossible to cull the dairy herds to advantage; and the dairymen that continue to carry on their business without it are, in a manner, working in the dark.

In regard to spaying cows for milking purposes, it is proved beyond a doubt that if a healthy cow is spayed six or eight weeks after calving when in her full flush of milk, and then fed well, that she will milk on an average about three years profitably. The method is valuable in regard to cows used for supplying hospitals, private families, cities, &c., on account of the uniform quality of milk given, but *especially valuable* to dairymen as a means of dealing with their *aged* cows profitably. When a cow in a dairyman's herd reaches the age of eight or nine years it is, as a rule, time to get rid of her. If she is spayed about six weeks after calving she will milk on with profit for a season or two, during which time she will improve in condition, and afterwards be easily disposed of as a forward store, or fattened for the butcher, and her place in the milking shed can be filled by a young, fresh cow.

When the first exhibitions and instructions in spaying were given a good deal of misunderstanding on the subject arose in the minds of the general public, many of whom got an idea into their heads that the Department of Agriculture was advocating the wholesale spaying of dairy herds, so that they could be milked continuously for a number of years. Such is not the case, and such a foolish idea would simply be laughed at by practical men living under our climatic conditions. The cattle that are being operated on are the culls, or unprofitable

butter producers, and the aged cows that are intended for milking on for a season, and then fattened for the butcher.

The spaying of cows for milking on for a season or two before they become too old is very important, and must result in undoubted benefit to the country. In travelling among the dairy herds of the State it is astonishing to see the large number of very old cows that are kept for milking purposes. These aged cattle *must* be absolutely unprofitable to the owners, for it is not reasonable to expect a cow of thirteen years, and perhaps older, on native pastures, to give a profitable supply of milk and also produce a calf.

Dairymen must bear in mind when culling their herds that strict attention must be paid to the *first principles* of breeding—that is, the use of pure sires on their good cows. Let them aim at breeding a general-purpose cow that will give a payable quantity of butter fat, and will, when done for milking, have a fair carcase of beef. In a rich district use the Shorthorn sire for preference; the Shorthorn and Ayrshire, or Shorthorn and Jersey cross produces a fair-framed animal. The steer calves bred in this way will meet with a ready sale, having well developed frames and decent shapes for fattening purposes.

That great interest is taken in spaying instruction is shown by the amount of work done during the past season; it also shows that the work is highly appreciated, and the dairymen recognise the great value of it in dealing with their culls and cows that are getting up in years; and also as a means or raising the standard of their herds in regard to butter production and general usefulness. In different districts of the State there has been given a total of 269 practical demonstrations of spaying; 350 dairy farmers or graziers have given cattle to be operated on; 3,030 cattle have been spayed, and 5,630 interested people attended the various exhibitions; and, although the operations included the work of about 200 pupils, the loss from deaths has been under (1) one in 200, or about ½ per cent. The very small percentage of loss has given confidence to the cattle owners, and is proving to them that spaying can be carried on without serious loss and with great profit.

To make a paying business of their dairy herds, dairymen must at once face the problem of making provision for winter feeding, and of providing shelter for their cattle from the cold bleak winds and rains. Until this is done their butter supply will be irregular and their profits uncertain.

Aim at keeping good profitable cows, and *feed them well*. Then, with all the advantages of scientific dairying, success will come.

SCALE OF POINTS FOR JUDGING A DAIRY COW, REGARDLESS OF BREEDS.

In the accompanying illustration are indicated the parts of the cow taken into consideration in judging her merits as a dairy animal.

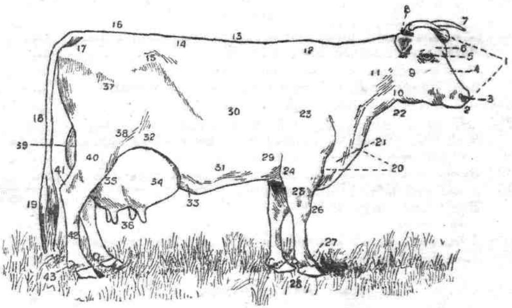


DIAGRAM OF COW SHOWING POINTS.

1. Head.
2. Muzzle.
3. Nostril.
4. Face.
5. Eye.
6. Forehead.
7. Horn.
8. Ear.
9. Cheek.
10. Throat.
11. Neck.
12. Withers.
13. Back.
14. Loins.
15. Hip bone.
16. Pelvic arch.
17. Rump.
18. Tail.
19. Switch.
20. Chest.
21. Brisket.
22. Dewlap.
23. Shoulder.
24. Elbow.
25. Forearm.
26. Knee.
27. Ankle.
28. Hoof.
29. Heart girth.
30. Side, or barrel.
31. Belly.
32. Flank.
33. Milk vein.
34. Fore udder.
35. Hind udder.
36. Teats.
37. Upper thigh.
38. Stifle.
39. Twist.
40. Leg, or gaskin.
41. Hock.
42. Shank.
43. Dew claw.

In judging dairy stock, 100 is assumed to represent the ideal or perfect dairy cow. The following is a list of the general qualities and particular parts considered, with the figures at the right indicating the "weight" or importance attached to each in making up the total of 100 points which stands for perfection :—

GENERAL APPEARANCE.

Constitutional vigour, as shown by size, apparent health, strength, activity, and "general appearance"	5
Form, wedge-shaped as viewed from front, side, and top ...	5
Quality, hair fine, soft ; skin medium thickness, loose, mellow, and unctuous, with yellow secretion	5
Temperament, active and nervous (but not "wild"), indicated by movements, eyes, and lean appearance	5

Head and Neck.

Forehead, broad and full	2
Horns, small and fine, not too long, set well apart	1
Eyes, large, prominent, bright, and yet placid	1
Face, lean, not too short, straight or slightly dished ...	1
Muzzle, clean and strong, mouth and nostrils large	1
Ears, medium size, fine in texture, yellow secretion abundant ...	1
Neck, rather long and thin, fine; clean throat and light dewlap	1

Fore-quarters.

Chest and *brisket*, broad and strong, low, but not too fleshy ...	3
Withers, well defined, firm, and lean	1
Shoulders, light, not fleshy, and oblique	1
Legs, straight, rather short, and not too large or coarse ...	3

Body.

Back, well defined, lean, open-jointed, not too level, and smooth; a good spine	3
Barrel or body, long and large; ribs broad, well arched, open, and well defined; a large, strong body	8
Heart girth, large and deep; abundant room for active heart and lungs	4
Belly, large, broad, and deep, with a large and strong navel ...	6
Loin, broad and strong	3

Hind-quarters.

Hips, wide apart	2
Pelvic arch, prominent and strong	3
Rump, long and wide	2
Tail, long, fine, with a good switch	1
Thighs, long and lean, no beefiness; thin flanks	3
Legs, straight, rather short, wide apart, giving open twist, and not too large or coarse	3
Fore udder, full, broad, and extending well forward, not fleshy	8
Hind udder, broad, full, and attached high, not fleshy ...	8
Teats, of good size and form, evenly placed	5
Milk veins, upon the udder and in front of it, prominent, large, and tortuous, leading to large, open "milk wells" ...	5

Notes.—In scoring or marking, give to each part the number of points which it appears to deserve upon the scale given; use fractions of one-fourth if necessary. Thus if forehead is broad, full, and satisfactory, mark 2; if neck is short, thick, and beefy, mark $\frac{1}{2}$ or $\frac{1}{4}$, or perhaps 0; if fore udder is deficient or defective, mark 6, 4, or 2, as the case may be. A good cow closely criticised and scored should have a total of 0 points or more.

—*From the* Year-Book *of the United States Department of Agriculture.*

PRESERVATIVES IN FOOD.

It is a relief to all those engaged in our export trade, whether as producers, manufacturers, or agents, to learn that definite and authoritative investigation has, at last, been initiated to set at rest the ever-recurring outbreak of criticism on the use of preservatives in products intended for human consumption. The constituted authority in Great Britain, the Local Government Board, one of whose functions is to exercise control over the welfare of British consumers of food, recognised that some definite limit must be enforced in the use of preservatives, and appointed a committee to inquire—

(1) "Whether the use of such materials or any of them for the preservation and colouring of food, in certain quantities, is injurious to health, and, if so, in what proportions does their use become injurious."

(2) "To what extent, and in what amounts, are they so used at the present time."

The committee was composed of the Right Hon. Sir H. E. Maxwell, Bart., M.P., F.R.S., chairman, Professor T. E. Thorpe, F.R.S., Professor Tunnicliffe, and Dr. Bulstrode.

Judging from the official report presented to the British Parliament, the investigation has been impartial, thorough, and comprehensive. The following paragraphs taken from the report are of interest to our producers :—

"68. Convinced as we are of the very general and increasing use of chemical preservatives by traders in the more perishable articles of food, we desire now to focus the evidence which has been placed before the Committee as to whether such preservatives may be expected to be attended with any risk to the public health."

"69. It should be borne in mind that under the conditions in which the population of Great Britain lives, and more particularly that portion of it inhabiting the large towns, some preserving agent, not necessarily chemical, appears to be needed in the case of no inconsiderable portion of its perishable food supply. It is common knowledge that the food-producing capabilities of this country do not suffice in all particulars for the needs of its population. Under these circumstances the total prohibition of preserving methods would clearly be likely to be attended with serious results to the public health, in that large quantities of food possessing highly nutritive value might in effect either be withheld from the poorer classes, or be liable to be consumed by them in a condition of incipient putrefaction. Obviously if an animal killed to-day were kept under a condition favorable to putrefaction, the meat of such animal would be unfit for human consumption on the morrow. In this instance the preservative method employed is to place the meat under conditions as antagonistic to putrefactive changes as local circumstances will allow."

"109. Compounds of boracic acid have not been proved to be more hurtful than saltpetre to the consumer, yet saltpetre has been used

from time immemorial in curing bacon, &c. The modern use of borax and boracic acid has enabled producers to dispense with a large proportion of common salt formerly necessary, thereby rendering bacon milder to the palate and protecting it from taint and fly-blow."

"112. After very carefully weighing the evidence we have come to the conclusion that as regards the trade in fresh and cured meat, fish, butter, margarine, and other food substances, in the consumption of which but small quantities of the antiseptic are taken into the system, there exists no sufficient reason for interfering to prevent the use of boron preservatives. Even butter, of which the imports from all countries, except Denmark, frequently contain boracic acid, is not consumed in such quantities by individuals as to convey more than a very moderate daily amount of the drug into the system. The evidence satisfies us that the amount of preservative corresponding to 0·5 per cent. of boracic acid is sufficient for the preserving of butter."

Recommendations of the Committee.

(*A*) That the use of formaldehyde or formalin, or preparations thereof, in foods or drinks be absolutely prohibited, and that salicylic acid be not used in a greater proportion than 1 grain per pint in liquid food, and 1 grain per lb. in solid food. Its presence in all cases to be declared.

(*B*) That the use of any preservative or colouring matter whatever in milk offered for sale in the United Kingdom be constituted an offence under the Sale of Food and Drugs Act.

(*C*) That the only preservative which it shall be lawful to use in cream be boric acid, or mixtures of boric acid and borax, and in amount not exceeding 0·25 per cent. expressed as boric acid. The amount of such preservative to be notified by a label upon the vessel.

(*D*) That the only preservative permitted to be used in butter and margarine be boric acid, or mixtures of boric acid and borax, to be used in proportions not exceeding 0·5 per cent. expressed as boric acid.

(*E*) That in the case of all dietetic preparations intended for the use of invalids or infants, chemical preservatives of all kinds be prohibited.

(*F*) That the use of copper salts in the so-called greening of preserved foods be prohibited.

(*G*) That means be provided either by the establishment of a separate Court of Reference or by the imposition of more direct obligation on the Local Government Board to excercise supervision over the use of preservatives and colouring matters in foods, and to prepare schedules of such as may be considered inimical to the public health.

DAIRY INSPECTOR'S REPORT, SHIRE OF NARRACAN.

The President and Councillors of the Shire of Narracan.

Gentlemen,—I have the honour to report having inspected 165 dairies, comprising 3,487 cows, since last meeting, and I have not seen any sign of disease in the herds inspected. They are in the pink of condition, but owing to the dry weather the milk supply is falling fast. There has been an increase during the year of 15 to 20 herds, there being now 408 as against 394 when completing my first inspection. Some 402 registration fees have been paid, making a sum of £120 12s. cash received. Three have paid twice and are asking for a refund. There are six outstanding fees yet to be paid. This now practically completes my year's work, and I beg briefly to review the industry in connexion with the Narracan Shire. We have about 9,000 milking cows, which, at £6 10s. each, means nearly £60,000 of capital among our farmers. This should bring back another £60,000 returns or more, for a cow that does not pay for itself in one year is not worth keeping.

Home Separators.—There are 180 hand and 35 steam separators, costing about £7,500. I find the majority think any kind of building good enough for separating and keeping the cream, which is a mistake, as every time the wind blows it causes the dust to rise and settle in the cream, thereby deteriorating its quality, while the machine would run much lighter, and with less wear and tear.

Steam Separators.—A great mistake, in my opinion, has been made in setting the boilers and separators in one room. Thus we find fuel, ashes, heat of the fire, &c., all brought in contact with the cream. It would be a great improvement were the boiler in a separate room, with a solid wall between it and the separator, thus keeping the cream as cool as possible and free from dust.

Keeping Cream.—In many cases of the smaller dairies cream is sent away twice a week, and some only once a week, or when the can is full, so that there is much cream kept in poor buildings, utterly unfit for the purpose, until it becomes too stale for good butter and liable to be fly-blown, as every factory manager knows only too well.

Milking Sheds.—There are marked improvements now going on in providing better accommodation. Some 49 new sheds have been erected, and a number of others had new floors and better drainage. The following different types of sheds, worthy of inspection, may be seen:—For best brick floor, Mr. A. Powell; slab, Dr. La rence, or Cleverdon's; wood drain, Mr. Fry; while Messrs. Dunbar and G. Evans have good buildings.

Cleanliness.—More attention is being paid to keeping the sheds and milking utensils clean. If a prize had been offered, Master Frank Savige would have been the winner.

GENERAL.—In milking there is still room for improvement. A few almost require the inspector to be present six days a week. Mr. Sommers, of Narracan, has introduced two milking machines, which are now being fitted up, and in a few weeks, when the cows have become a little more accustomed to the alterations, the public will have an opportunity of witnessing them in operation. It is to be hoped Mr. Sommers will be well repaid for his spirited enterprise, which would be a great benefit to large dairymen. In conclusion, let me say that we have, as a whole, a class of dairymen that any district may well be proud of, and some splendid herds are to be found all through the shire. There have been many good bulls introduced during the last year or two, chiefly Ayrshires, Jerseys, and milking shorthorns. The class of young cattle to be found all round speaks well for the dairying industry in the future. For the best cow-shed, separating and cream-room, Mr. Alfred Powell easily stands first; for enterprise, Mr. Sommers; for cleanliness in milking shed, yard, cows, and for clean milking, Frank Savige, Narracan, and Kirwin, Willowgrove.

S. GIBLETT, Dairy Inspector.

VITICULTURAL BRANCH.

TREATMENT OF VINTAGE BY DIFFUSION.

By Pierre Andrieu.

Papers read before the Œnologic Congress of Toulon in October, 1898, and before the "Session Générale de la Société des Viticulteurs de France" in Paris, in March, 1899.

TRANSLATED BY

RAYMOND DUBOIS AND W. PERCY WILKINSON.

CHAPTER I.

Composition of Grapes.

It is desirable to shortly describe the composition of grapes, as this will assist us to prove the value of the treatment of vintage by diffusion, and we take this opportunity of expressing our appreciation of the researches conducted by MM. Aimé Girard and L. Lindet,* on the composition of grapes.

Their work serves as the basis of the following explanations :—

The Vintage.†—The vintage is composed of *stalks*, that is to say, the peduncles and pedicles carrying the berry, and the *berries*, or fruit.

The fruit contains the *pulp*, which is the most important part ; the *skin*, surrounding the pulp, and the *seeds* or pips enclosed in the centre of the pulp.

The pulp yields the juice or "must." The stalks, skin, and pips form the *solid portion* of the vintage.

As a rule the average percentage composition in weight of the four parts constituting the grape is :—

Weight of stalks ...		3
Weight of berries : 97	Pulp ...	85
	Skin ...	8
	Pips ...	4
	Total ...	100

The weight of the skins, as compared with that of the berries, varies with the variety, and also according to whether the season is more or less dry or hot.

The weight of the pulp varies between 85 and 86 per cent. of the weight of the grape.
The weight of the skin ,, ,, 7 and 9 ,, ,, ,,
The weight of the pips ,, ,, 2 and 6·5 ,, ,, ,,

Composition of Pulp and Juice.—The sugar is contained in the pulp. The sugar strength of the pulp, and therefore of the juice or

* Aimé Girard *et* L. Lindet.—*Recherches sur la Composition des Raisins des principaux Cépages de France.* Paris, 1895.

† In the following pages we will mean by the word *vintage* the produce resulting from the gathering of the grapes.—TRANS.

must, is dependent on the variety cultivated; but it may reach, for all varieties, a high figure in certain years. The weight of sugar may reach 20 per cent. of the weight of the pulp, or even more in good years, and 16 per cent. only in an average year.

The pulp contains also bitartrate of potash, free acids, mainly malic acid, and nitrogenous soluble matters, &c.

In the pulp the juice is contained in thin walled cells, which break easily, and give to the pulp its gelatinous appearance. The weight of these cell walls does not reach 0·5 per cent. of the weight of the berry. The tissues of these walls, composed mainly of cellulose, form the greater part of the deposit called *mud*, and thicken the juice coming out of the crushers or presses.

The volume of the juice is equal to its weight divided by its density. For instance, 85 kilos of juice of a density of 1·080 represents a volume of 85 ÷ 1·080=79·43 litres.

Composition of the Skins.—The skins contain the colouring matter, bitartrate of potash, acids, tannin, in the proportion of about 1·25 per cent. of the weight of fresh skins, ligneous matters, &c.

Composition of the Seeds.—The seeds contain a special tannin, neutral oil, resinous and ligneous matters, &c.

Composition of the Stalks.—These contain tannin, bitartrate of potash, free acids, resinous and ligneous matters.

Skins, seeds, and stalks—that is to say, the solid part of the bunch—contain also nitrogenous and mineral matters, and a large proportion of water of vegetation.

Water of Vegetation.—The weight of the water of vegetation in the pulp is in inverse ratio to the sugar strength. It varies between 61 and 71 per cent. of the total weight of the vintage, or between 64 and 74 per cent. of the weight of the berries alone.

The solid matters also generally contain large proportions of water of vegetation. For 100 kilos of vintage we find the following figures :—

The stalks	contain from	1.50 to 3	litres of water of vegetation.	
The skins	,, ,,	3 to 7	,, ,,	,,
The seeds	,, ,,	0·50 to 2	,, ,,	,,
Total	...	5 to 12	litres.	

The water brought to the vat by solid matter in the vinification of red wine is generally not taken into consideration, but we must not forget that it lowers the alcoholic strength of the wine. We know that when fermentation is completed the solid matters (*marc*) coming out of the press only contain wine, which has replaced the natural water.

When the soluble matters contained in the solid matters of the vintage are extracted by the diffusion method, the water contained in the latter does not come out of the tissues containing it. These tissues do not absorb sugar, any more than when they are naturally in contact with the pulp in the berry.

CHAPTER II.

Methods of Vinification actually in use—Loss of Juice, Wine, or Alcohol.

Viticulturists do not generally suspect the poor results they obtain from the diverse treatments of their vintage by the usual methods. We intend to try and show the importance of the losses resulting from vinification of red wine, as well as white wine, and we will try to indicate how diffusion may reduce these losses to insignificant proportions, and, at the same time, improve the quality of the wine.

Vinification of Red Wine in Temperate Climates.—To render our explanation as clear as possible, we will extract the following table from the work of Girard and Lindet, selecting only four of the 25 principal varieties they studied. The solid matters studied in this table are stalks, skin, and pips.

One hundred kilos. of vintage of the following varieties gave in 1893—

—		SOUTH OF FRANCE.			BOURGOGNE.				GIRONDE	
		Aramon.		Black Pinot.		Gamai.		Cabernet Sauvignon.		
Pulp and juice ...			85·38		86·13		86·36		85·26
Solid matters	Desiccated ...	4·00	14·62	6·58	13·87	5·50	13·64	5·75	14·74
	Water of vegetation	10·62		7·29		8·14		8·99	
			100·00		100·00		100·00		100·00
Specific gravity of juice ...			1·064		1·092		1·095		1·088
Volume of juice in litres ...			80·24		78·87		78·86		78·36
Volume of juice and water of vegetation			90·86		86·16		87·00		87·35
Weight of sugar in kilos. ...			11·910		16·650		17·426		15·269
Extractive matters other than sugar in juice			1·458		1·225		1·238		1·200
Soluble extractive matters contained in solid parts			0·910		1·456		0·987		1·018

We will take the Gamai as an example, although our argument would apply equally well to grapes of other varieties. We see in this table that the solid matters of its grapes contained 8·14 kilos. of water of vegetation per hundred kilos. of vintage. If these matters are put into the fermenting tank, their water of vegetation will become mixed with the must during fermentation, and partake of the formation of the wine. When we press the marc we know that it contains nothing but wine. The density of the Gamai must is 1·095. This figure is rather high, but is explained by the fact that in 1893 the maturity was exceptionally good. With regard to the indication of the mustimetre,

as read on Salleron's table of sugar and alcoholic strength for finding the probable alcoholic strength of the wine, knowing the density of the must, we may here point out a serious mistake in the table. If white wine is made from Gamai, its alcoholic strength might be approximately 13·1 per cent. by volume. This is the figure indicated by the table opposite the density of 1·095; but, if red wine is made, its alcoholic strength does not correspond with the figures of Salleron's table, which often perplexes vignerons, who wrongly suspect the mustimetre to be badly graduated, or the fermentation to be incomplete, while the error is simply due to the table. If we study the Gamai again we see that the weight of sugar, which is 17·426 kilos., will be dissolved in two liquids (must and water of vegetation), forming a total volume of 87 litres. Each litre of the mixture will therefore contain 200 grammes of sugar only, corresponding to 11·8 per cent. of alcohol by volume. The difference between this figure and that of the table (13·1) is 1·3. We will see later on that the true figure may sometimes be as low as 11·4, the difference being 1·7.

Let us assume that the fermentation of the Gamai is completed, and the first wine racked. The marc is left a certain time in the tank to drain, and then carried on the press where the cake is made. This cake will be pulled to pieces and formed again after each pressing. We collect in this way the first wine on one side and the press wine on the other.

What is the quantity of wine made from 100 kilos. of vintage? What is the quantity lost? What quantity of alcohol has been lost? We intend to try and answer these questions.

A.—According to Pasteur 100 kilos. of grape sugar yield 48·36 per cent. of alcohol in weight, or 60·88 litres in volume. Practically, if we take into consideration the evaporation of alcohol, we may consider that the yield is only 58·8 litres, or that 17 kilos. of sugar yield 10 litres of alcohol. The difference between the theoretical yield and the practical yield of 1 kilo. of sugar is 0·0208 litres. The 17·426 kilos. of sugar contained in our Gamai will, during fermentation, lose 0·35 litres of alcohol. Further, during this fermentation over 4 cubic metres of carbonic acid gas will be disengaged from the vat, and carry away 0·35 litres of alcohol together with water.

If these vapours were condensed, they would form a volume of liquid of 1·40 litres, with a proportion of 25 per cent. of alcohol in volume.

B.—The marc left in the vat weighs about 40 kilos. It offers a large surface of evaporation on account of its structure. What will be the quantity of liquid evaporated? It will vary with the alcoholic strength of the wine, with the temperature, the rate of motion, and hygrometric state of the air. It will vary also with the time during which the marc is draining, carried to the press, and pressed. We consider that this loss of liquid averages 3 per cent., that is to say, 1·20 litres of an alcoholic strength of 25 per cent. for each 40 kilos. of marc.

C.—After pressing, the marc will contain the solid matters of the bunch and the wine which has replaced the water of vegetation. This marc will weigh about 12·5 kilos., and contain a volume of wine equal to 58 per cent., that is to say, 7·25 litres.

The volume of liquid contained in 100 kilos. of vintage is, as we have seen			87·00 litres
We must deduct from it the loss by evaporation—			
Of the liquid *A*	1·40 litres	}	2·60 "
Of the liquid *B*	1·20 "		
There remains			84·40 litres
D.—This volume of 84·40 litres is increased by the addition of 500 to 600 grammes of extractive matters derived from the marc, but it is diminished, on the other hand, by the contraction of the mixture of alcohol and water. We may assume the difference of these two actions to be			0·50 litres
Volume remaining			83·90 litres
Further, we must also allow for the wine contained in the marc (*c*)	7·25 litres	}	8·00 "
Wine lost in manipulation ...	0·75 "		
The total quantity of wine remaining will be			75·90 litres
Composed of wine of first racking	50·00 litres	}	75·90 litres
Press wine	25·90 "		

One hundred kilos. of Gamai will therefore be transformed in (weight)—

	75·90 litres of wine, weighing		75·90 kil.
	Pressed marc (*c*), weighing		12·50 "
Loss	2·60 litres (*A* and *B*) alcoholized water at 25 per cent. evaporated	2·524 kil.	11·60 "
	Wine lost in manipulations ...	0·750 "	
	Carbonic acid gas (46·56 per cent. of 17·426 kil. of sugar) ...	8·113 "	
	Other losses	0·213 "	
	Total		100·00 kil.

Coste-Floret, the well-known viticulturist, who published several studies made at his cellars at Saint-Adrien, near Servian (Hérault), gives the following figures for the vinification of 100 kilos. of Aramon, yielding a wine containing 10 per cent. of alcohol by volume :—*

Wine of first racking, and press wine, 70·70 litres, weighing ...	77·00 kil.	100 kil.
Marc after pressing	11.70 "	
Loss by manipulation, lees, evaporation, and carbonic acid gas ...	11·30 "	

* COSTE-FLORET, *Vinification des Vins blancs*, page 57, vol. 1, Montpellier, 1895.

Coste-Floret considers the loss to be, after first racking		11·30 kil.
We must deduct from this figure carbonic acid gas	7·50 kil.	9·00 „
Wine lost by manipulation, absorption, lees	1·50 „	
The loss by evaporation would then be ...		2·30 kil.

We estimated, in our first example, the loss by evaporation to be 2·524 kilos. for a wine containing 1·4 more alcohol. Our results, therefore, agree.

Let us come back to the fermentation of Gamai, and see what proportion of loss we may avoid.

This will be—1st. The loss *B*, resulting from the drained marc, and caused by the evaporation of 300 cubic centimetres of alcohol, or 2·9 per cent. of the total volume of alcohol. This means that the wine will weigh 11·4 instead of 11·8.

2nd.—The loss *C*, wine remaining in the marc after pressing. It is about 7·25 litres for 75·90, that is to say, 9·55 per cent. of the total amount of wine obtained.

These two losses make a total of 12·45 per cent.

Finally, one might also avoid the press wine, which forms a third, or at least a quarter, of the total wine obtained. It is a rough wine, thick, harsh, and has a value always inferior to that of wine of first racking.

Vinification of Red Wine in Hot Climates.—Let us now study the fermentation in hot, dry climates, such as the south of Spain and Italy, Algeria, and Tunis. As we do not know the composition of large bearers, such as Alicante, Mourvedre, and Morrastel, cultivated in Algeria, we will again take the instance of our Gamai with the composition indicated above, but assuming, however, a greater sugar strength in relation to those of hot countries—250 grammes of sugar per litre of must, for instance. The alcoholic strength of the wine resulting from it ought to be, according to Salleron's table, 14·7. With the dilution of 8·14 litres of water of vegetation this strength will be brought down to 13·3, and with other losses of alcohol which we are going to explain, totalling 0·6, it will be brought down to 12·7. The difference of apparent losses will, therefore, be 2.

The weight of juice remaining the same as above, and that juice containing 19·5 kilos. of sugar instead of 17·423, its density will be increased and its volume reduced to 78 litres instead of 78·86. If we add 8·14 litres of water of vegetation, the total volume will be 86·14. We then obtain the following results:—

a.—Assuming that 17 kilos. of sugar yield 10 litres of alcohol, the 19·5 kilos. of sugar contained in our must will yield 11·47 of alcohol; the theoretical yield being 11·88, the loss by evaporation is 41 centilitres. But the temperature of fermentation will be at least 4° or 5° C. higher than in a temperate climate, and will be about 40° C.; the tension of alcoholic vapour is therefore increased by about 30 per

cent. The loss will therefore be 30 per cent. more, that is to say, 12 centilitres. The total loss of alcohol will therefore be 0·53 litres, together with three times that volume of water, bringing the total evaporation up to 2·12 litres.

b.—The drained marc weighs at least 40 kilos. The evaporation may be estimated at 4 per cent. (mixture of water and alcohol at 25°), that is to say, 1·60 litres.

c.—The same loss as in the first example, that is to say, 7·25 litres.

Total volume of the liquid		86·14 litres
We must deduct loss *a*	2·12 litres	3·72 "
" " " " *b*	1·60 "	
We remain with		82·42 litres
d.—The decrease of volume will be as with *D* ...		0·50 "
Volume remaining		81·92 litres
Further, we must also allow for the wine contained in the marc (*c*)...	7·25 litres	8·00 "
Wine lost by manipulation ...	0·75 "	
The total quantity of wine remaining will be		73·92 litres

We have shown in *a* a loss of 0·12 litres which might be avoided.

We have shown in *b* a loss of alcohol of 0·40 litres which might also be avoided.

The total loss of 0·52 litres of alcohol, which for 81·92 litres of wine corresponds to a loss of 0°6, represents a loss of 4·5 per cent. of the alcoholic strength of the wine, which was 13°3.

The loss *c*, of 7·25 litres, corresponds to 9·84 per cent. of the wine obtained.

The total of these two losses is 14·34 per cent. of the total wine obtained, not taking into consideration the low quality of the press wine.

We estimated the total yield of the wine at 73·92 litres per hundred kilos. of vintage, which corresponds, for 100 litres of wine, to 135 or 136 kilos. of vintage. We also pointed out a difference of 2° between the alcoholic strength given by Salleron's table and the alcoholic strength of the wine after complete fermentation. Further, in warm climates it is recognised in practice that from 135 to 140 kilos. of vintage are required to make 100 litres of wine at 13°, and that the difference between the degree given by the mustimetre and that of the wine when finished varies between 2 and 3°. The yields we have given are therefore approximately correct.

Vinification of White Wine.—In the manufacture of white wine the juice extracted by crushing, draining, and pressing is alone submitted to fermentation. The marc is thrown away or distilled after fermentation.

The juice is contained inside the berry in a great number of small cells forming the pulp. These cells are separated by membranes which give the pulp its gelatinous aspect. According as those membranes

are more or less tough the berry is said to be *pulpy* or *juicy*. If the berry is juicy, and if it contains a little sugar, the immediate yield in juice during the crushing, draining, and pressing is always higher, and easier to obtain.

The grapes are not always crushed to extract the juice. In champagne, for instance, the bunches are put direct into the press, and the pressure alone opens the berries, compresses them, and expels the juice.

In some vineyards the white grapes are crushed mechanically and then placed on screens, where they drain for a few hours, after which they are pressed to extract the rest of the juice.

It requires a long time to dry the marc by pressing. At Chateau Yquem, near Sauternes, the vintage is gathered very ripe, crushed the first time under the feet on the table of the press, where it drains for a few hours; it is then pressed three times, pulling down the cake between each pressing. This lasts 24 hours. The next day the marc is put in smaller presses, when it is again pressed three times, pulling the cake to pieces between each pressing. The whole work is completed in 84 hours.

The complete extraction of the juice requires, therefore, a series of operations which, in most cases, require at least 24 hours. Notwithstanding the enormous pressure exerted on the marc, and the pulling of the cake to pieces, the results are not very satisfactory.

What is the yield in juice and what the loss?

Before answering these questions we will ascertain what volume of juice is contained in 100 kilos. of grapes, white or black, used for making white wine. Girard and Lindet, in their work, mentioned above, give the following indications. Their researches were made in 1893, a year of exceptionally good maturity except for the South, where it was simply normal. The juices, on account of their high density, may be regarded as representing volumes rather under the average.

100 kilos. of vintage of the following varieties gave in 1893:—

District.	Cépages.	Density of Juice.	Weight of Juice.	Volume of Juice.
			Kilos.	Litres.
Bourgogne ...	White Pinot ...	1·094	87·95	80·39
Champagne ...	Black " ...	1·100	85·27	77·52
" ...	White " ...	1·074	86·34	80·39
West ...	White Chenin ...	1·097	84·98	77·47
Charentes ...	Folle-Blanche ...	1·077	84.40	78·40
South. ...	White Picquepoul	1·060	88·08	83 10
" ...	Aramon ...	1·064	85·38	80·24

We must point out that for the South the Picquepoul and Aramon grapes were gathered from a vineyard planted in the sands of the littoral, where the vines are in moist surroundings, and yield large quantities of must of low density. Inland the density of Aramon juice reaches easily 1,075, and the volume of juice is then 79 litres.

We are going to give a few examples of the yield in juice after pressing. We will not consider the treatment of vintage with continuous presses, or with the æro-turbine of P. Paul, as in these two cases the juice being mixed with the water of vegetation, and with a certain proportion of these same matters extracted from the solid matters, it is impossible to ascertain the yield in pure juice.

According to the above table, the White Pinot of Champagne contains 80·39 litres of juice, and the Black Pinot 77·52. If these two varieties are treated together and in equal parts, the average yield will be 78·95 litres. Further, in practice, 1,500 litres of vintage have to be pressed to obtain 10 hectolitres of must; 100 kilos. of vintage therefore yield, at the most, 67 litres; 11·95 litres will therefore remain in the marc, bringing the loss to 17 or 18 per cent. of the juice extracted.

In the vineyards of Saumur, where the White Chenin is cultivated, 350 kilos are required to produce 225 litres of wine, which means a yield of 64·3 litres. But according to the above table, White Chenin contains 77·47 litres of juice per 100 kilos; the loss is therefore 13 litres, or 20 per cent. of the juice extracted. In the district around Cognac the Folle-Blanche only yields practically 67 litres of vintage per 100 kilos. of grapes. If this is compared with the theoretical yield, 78·40 litres, it brings the loss to 15 per cent.

In the South of France, where Aramon is used for making white wine, one cannot obtain more than 70 litres, partly white, partly red, after crushing, draining, and pressing. If we compare this with the theoretical yield of 79 at a density of 1,075, we find a loss of 17 per cent. of the juice extracted.

To sum up, when fresh vintage is treated by pressing, there is an average proportion of 16·5 per cent. of the juice extracted remaining in the marc after the operation.

Conclusions.

For the Vinification of Red Wine.—The loss of alcohol by evaporation of the marc and wine remaining in it reaches from 12 to 14 per cent. of the wine extracted. Further, the wine extracted by the press is of lower market value.

For the Vinification of White Wine.—The loss of juice remaining in the marc after pressing reaches an average of 16·5 per cent. of the juice extracted.

It is true that this wine and juice remaining in the marc may be distilled, but the low price of alcohol renders this operation impracticable.

In the south 100 litres of marc cost 1s. For 12·5 kilos. of pressed marc, which represents the residue of the vinification of 100 kilos. of vintage, we may make a profit of 1½d., which is insignificant.

In Bourgogne the marcs are valued at from 5s. to 7s. per 100 kilos., but they are used to make sugar wines, and this price will only prevail as long as sugar wines are made.*

* New Law, 1901.

CHAPTER III.

Treatment of Vintage by Diffusion.

We have just studied the loss of juice or wine resulting from the old method of manufacturing, and without taking into account unavoidable losses, we found that from 12 to 16·5 per cent. of the juice remained unutilized. We intend now to ascertain the losses resulting from the diffusion process and compare it with the above.

Grapes are admirably adapted to the diffusion treatment as proved by the following experiment:—

If we take 10 kilos. of grapes and crush them we will find the density of the must to be for instance, 1·080. Let us assume these grapes are composed of—

Juice	8·6 kilos.
Solid parts	1·4 "
Total	10 kilos.

By dividing the weight of the juice by its density we obtain its volume, which in this case will be 7·96 litres.

Let us pour into a vessel 7·96 litres of ordinary water and add to it the 10 litres of crushed grapes. If diffusion takes place rapidly and completely the liquid resulting from the mixture should indicate a density equal to the average of the densities of the two liquids, in this case an average of 1,080 and 1,000—that is to say, 1,040. How long will it take for that density to reach 1,040; or, in other words, for complete diffusion to take place? From 15 to 30 minutes. Grapes, therefore, are perfectly adapted to diffusion.

To obtain the methodical exhaustion of the vintage and the juice—reaching if desired a density equal to that resulting from pressing—we must form what is termed a *diffusion battery*. This is composed of 10 or 12 tanks filled with crushed vintage (before or after pressing), and hermetically closed.

Figure 1 gives an idea of the battery. Tank No. 1 shows a vintage resting on two screens, *a*, *b*, helping the circulation of the liquid.

This circulation takes place from bottom to top in each tank, and as the bottom of each tank communicates with the top of the next by a connecting pipe, the current takes place from one extremity of the battery (in this case tank No. 1) to the other (tank No. 9). The extra tank (No. 10) is filled with vintage while the rest of the battery is working.

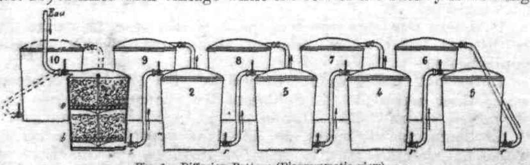


Fig. 1.—Diffusion Battery (Diagrammatic view).

The water is introduced by a special piping in the top part of the first tank, and the current takes place. To overcome the resistance

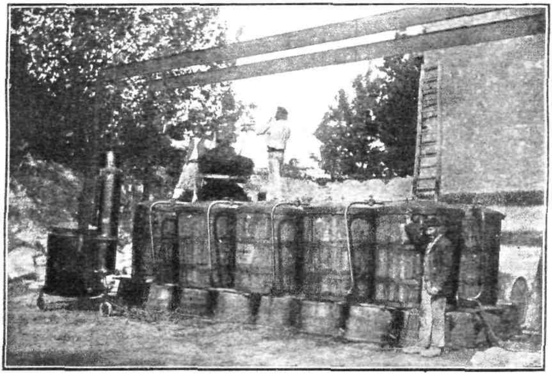


FIG. 2.—VIEW OF DIFFUSION BATTERY.

the vintage offers to the circulation of the water on account of its gelatinous nature, a pressure of from 4 to 5 metres is exerted over the liquid by fixing a tank at that height.

When the water is introduced into the first tank the tap placed at the bottom of the last tank is opened. The water under pressure forces the must as would a piston, and, as all the tanks are in communication, the forced must flows through the tap of the last tank. The juice of the grapes comes out of the battery absolutely pure and bright; this brightness being due to the marc acting as a filter.

At the first time, however, the density of the must diminishes—this corresponds with the time when the mixture of water and must begin to flow. The operation is then stopped. Tank No. 10, which has been filled with fresh vintage, is connected with the battery and tank No. 1, through which passes a volume of water equal to that of the must contained in all the battery, is exhausted, and therefore disconnected.

The numbering of the tanks is only conventional. The water will now flow through the top of the new first tank (No. 2 in the figure). The No. 10 tank will become the last tank, or tank No. 9, and tank No. 1 will become tank No. 10, after being emptied and filled with fresh vintage.

The new battery being formed, the pure must will flow from the new tank No. 9 (8 in the figure), and the flow will continue until the density of the must drops, which corresponds, for a good vintage, to a given volume of must.

Such is the working of a diffusion battery, in which the sugar strength goes on increasing from the first tank, where it is *nil*, to the last, where it is equal to that of the must. This treatment, done at ordinary temperatures, exhausts perfectly the vintage used for making white wine before draining following crushing.

In the manufacture of red wine we must further extract the colouring and extractive matters contained in the solid part of the grapes, and which give red wine its characteristics. This is done by a special application of heat, as we will show when describing the experiments made at Cabezac, near Narbonne.

Experiments on the Diffusion of Fresh Vintage Made at Cabezac (Aude).*

(1) These experiments were made at the beginning of October, 1898, at Château Cabezac, in the presence of its owner, Mr. Marty, Henry Ader, civil engineer, and several other viticulturalists of the district. The vintage was a mixture of Alicante, Carignane, and Aramon, the latter variety predominating.

Our diffusion battery, built by the firm of Egrot and Grange, Paris (Fig. 2), was composed of 10 tanks, shaped like a conic frustrum, of a calefactor (optional), and a luff tackle, with which the exhausted marc of the head tank could be taken in one operation from the top opening. Two men may be seen in Fig. 2 standing on the battery and working the tackle.

* Read before the Œnologic Congress at Toulon, on the 14th October, 1898.

These tanks were made of wood, and closed at the top by a tinned copper lid fixed with butterfly nuts. They were placed on comports upside down. The height of each tank inside was 1·20 metres, the average diameter 90 cms. They contained 720 kilos. of crushed vintage, or about 1,100 kilos. of vintage if, during the filling of the tank, the bottom tap was open to let flow the juice draining naturally, or again, 1,400 kilos. of vintage previously crushed and submitted to special drainage.

Inside each tank were two tinned copper screens, one a little above the bottom, the other half-way up. Each screen is formed of a copper tray pierced with holes. These trays are corrugated, so as to increase the surface with the object of having the whole surface of the perforations equal to that of the circle of the screen. The special shape of these screens regularized the circulation of the liquid and facilitated it, in so far as the must rests mainly on the top of the corrugations, and the pulp does not obstruct the perforations placed at the bottom of the corrugations. The two screens are fixed to a vertical rod, and the tackle lifts the whole, rod, screen and marc, in one operation.

The nine tanks were filled with crushed vintage, and the water of the tube connected with the tank placed 5½ metres above them. The current takes place from the head to the tail tank of the battery by the connecting tubes placed between each tank, and the must came out of the cistern through the delivery pipe of the tail tank and collected in a hogshead. The first important point was to ascertain if the liquid would easily traverse the vintage, if the screens would not obstruct the current; and, further, the degree of limpidity of the must. The experiment was therefore started with cold water. We will later on explain the use of heat generated from the calefactor.

With cold water we recorded the two following important facts:—

1st.—The circulation of the liquid takes place easily, and the rate of flow of the must regulated by the exit tap of the tail tank could be as great as necessary.

2nd.—That the must came out almost bright, and when put in a trial glass did not deposit any mud, while the same juice collected from the crusher deposited half its volume of mud. The whole mass of the vin age, therefore, acts after the fashion of a filter, and this accounts for the limpidity of the must at the exit.*

During the experiment with cold water samples of the liquid were taken at the bottom of each tank, that is to say, where the deposit was the highest. The liquid of the head tank was only water, its density being 1,000. This density gradually increased in the following tanks till the tail tank was reached, with an average density of 1,066; the must coming out of the crusher at a density varying between 1,064 and 1,069.

We could have collected must of an average density of 1,066 from each tail tank. We would have obtained a wine of an alcholic strength 1 deg. superior to that of the wine obtained by the fermentation

* For the vinification of white wine it is preferable to allow the crushed vintage to drain before putting it in the diffusion battery. This will be explained further on.

of the whole vintage (juice and solid parts). This is the advantage of this process when the must is not rich enough in sugar.*

But as the composition of 100 kilos. of vintage with a must having a specific gravity of 1,066 was—

85 kilos. *of must with a volume of*	79 lit. 7
15 kilos. of solid matters (stalks, skins, seeds), containing *a volume of water of vegetation equal to*	9 0
	88 lit. 7

We argued that with the usual process of vinification of red wine, the water of vegetation added to the must by the solid parts was, in this case, 9 litres for a total volume of 88·7 litres, or in other words of 10·4 per cent. By bringing down the average density of the must to 1,059·2 instead of 1,066, we would obtain a wine of an alcoholic strength equal to that of the wine made by fermenting the liquid. We collect, therefore, from the tail tank, a must of an average density of 1,059.

As each tank contained 720 kilos of vintage the quantity of must flowing from the tail tank should have been $720 \times 88{\cdot}7 = 638$ litres. But a loss of 2·5 per cent., which we will hereafter explain, diminished those 638 litres by 16, leaving 622 litres to be collected from each tail tank. This means a rate of flow of 15 to 16 litres per minute.

Forty minutes were required to empty the exhausted tank and fill it again ; therefore, forty minutes were required to treat 720 kilos. of vintage. This was *equivalent to* 1,080 *kilos. of vintage per hour.* If the vintage had been drained for an hour beforehand, we should have treated about 1,350 kilos. of vintage in 45 minutes, that is to say, 1,800 kilos per hour, or again, 21,600 kilos per day of 12 hours, this being equivalent to about 190 hectolitres or 170 hectolitres if the grapes were not very juicy.

In our treatment of 720 kilos of vintage per tank, when we emptied the exhausted head tank of the water it contained † the marc remaining should be considered as composed of 6 per cent. of dry matters, equivalent to 43 kilos. This marc completely soaked with water should have weighed 200 kilos, and contained 15.7 litres of liquid. By squeezing this marc between the hands we obtain a very turbid liquid of a specific gravity of 1,005. 1 litre of this liquid contained approximately 13·3 grammes of sugar, and the 157 litres a total weight of sugar of 2·08 kilos. The saccharine strength of the must being 130 grammes per litre, this was equivalent to a loss of 16 litres of must for the 638 litres mentioned previously, or 2·5 per cent.

Such are the results obtained by the use of cold water ; they would be practically useful if we desired to obtain wines with a more delicate taste, containing less dry extract, and about half the colour contained in the skins.

* See explanation Chapter II.

† The water flowing from the exhausted tank may be used over again. The water absorbed by the marc alone is lost if the must has not been diluted. In the latter case as the marc naturally contains 9 litres of water of vegetation, 6 kilos. of dry marc or 64 litres per 43 kilos. of dry marc, the loss in water would be 157 − 64 = 83 litres for 720 kilos. of vintage. Therefore, the quantity of water required would be 12 per cent. of the weight of the whole vintage.

This cold treatment can also be applied to the exhaustion of marcs of white wines after drainage; or again, to the exhaustion of marc of red grapes after these have been drained for making white wine, and when it is not necessary to extract the whole of the colouring matter.

We have now to study in what way heat can help to the extraction of colouring and extractive matters contained in a soluble state in the solid parts of the grapes. In this case it is necessary to use a calefactor.

This calefactor, shown on the left of Fig. 2, is formed of a boiler and fire-grate, and a vertical copper cylinder placed behind the boiler. This cylinder is composed of a vertical bundle of tinned copper tubes. The boiler and the cylinder are full of water, and connected by a thermo-siphon, and the must travelling through the bundle of tubes from bottom to top becomes hot in contact with the warm water. The whole apparatus is mounted on wheels, and placed alternately in front of each tank.*

This calefactor is placed between tank No. 3, and tank No. 4 (Fig. 1). Each time the head tank of the battery is altered the numbers of the tanks diminish by one, as we have already said, and the calefactor must be moved the length of one tank to the right. During the operation it receives the liquid coming out of tank No. 3, heats it, and carries it into tank No. 4. At that moment the must has lost by diffusion three-quarters of the sugar and soluble matters. At each displacement of the calefactor the must of No. 3 (old No. 4) travels towards the new No. 4. It is, therefore, the must already heated which passes again through the calefactor, regaining its temperature of from 60° to 70° C. which was diminished by about a quarter.

The object of this arrangement is to concentrate the heat in tank No. 4 of the battery. The other tanks are at a lower temperature, which diminishes gradually towards the extremities of the battery. At the head extremity each No. 1 received 620 litres of cold water, while at the tail end each No. 9 brought 720 kilos. of crushed vintage. The must, therefore, could only come out of the cistern at a temperature almost equal to that of the vintage before treatment.

The extraction of colouring and extractive matters from the solid parts of the grapes by the use of heat, cannot give a bad taste to the must or to the wine resulting from it. Kayser, director of the Œnologic station of Gard, proved, during later years of patient study on selected yeast, that vintage submitted to a temperature not exceeding 70° produces wine free from a cooked taste. In our machine, where the vintage is not in contact with the air, and where it reaches a temperature of 60° to 70° only when three-quarters of its sugar and acids are already extracted, this cooked taste is still less to be feared.

A temperature of 60° to 70° helps greatly the diffusion of colouring, and extractive matters contained in the tissues of the solid parts, and its action has more effect than maceration during many days in a fermentation tank. Anybody may repeat the following experiments.

* A special box communicating with the must at the exit of the tubular bundle allows the addition of a small quantity of tartaric acid so as to neutralize the action of any lime contained in the water.

Take some red grapes, crush and place them in a vessel containing a little water, heat the whole to 60° or 70° during 20 or 30 minutes. The skins yield all their colouring matter and become colourless,* while the stalks and pips yield a certain percentage of soluble matters. If this must is left to cool down, and is tasted, it is found to have a clean taste.

The diffusion does not take place through the skin of the berry, the outside surface of it being impermeable. If a black grape berry is placed in a shallow capsule so as to have the opening of the pedicle over the water, and if the water is heated to 75°, the water remains colourless, and the sugar does not diffuse.

Or again, if whole berries of black grapes torn away from their pedicles are completely immersed in water at 75° during one hour, a small portion of the colouring matter only (the colour of the water being only pink, yellow, and never purple), diffuses through the small opening of the pedicle, and only 20 per cent. of the sugar. We only mention the results of the experiments to show that it is necessary before placing grapes to diffuse in warm or cold water, to have them crushed by machines which thoroughly crush all the berries.

The experiments of heating with our apparatus could not last as long as we desired. We could only install the machine towards the end of the vintage, and the grapes being all gathered, we could only heat one tank. However, this was sufficient to show that the skins had passed from black to a pink tint, and it is evident that if we had continued the heating the decolourizing would have been more complete. On the other hand, the exhaustion of the sugar would have been still more perfect than that obtained with cold water. Although we were not able to judge of the respective qualities of the two wines obtained with the same vintage treated by the usual process, and by our process, the clean taste of the treated must proves that the quality of the wine would have been at least equivalent, as we had already ascertained by experiments made on smaller quantities.

To sum up, our experiments were complete so far as diffusion with cold water was concerned. The machine worked satisfactorily, and gave a must similar to that obtained with crushed grapes simply drained, with more colour however. Our experiments with heated must were sufficient to show that the decolourizing and the extraction of soluble matters of the solid parts of the grapes are easy operations.

Different Methods of Treatment by Diffusion.—This machine, with ts ten tanks containing 760 litres, may be used in three different ways.

1st. Allow the crushed vintage to fall into the empty tank, fill it and connect with the battery. We treated, by this method, 1,080 kilos. of vintage per hour.

2nd. Fill the tank with crushed vintage, and leave the bottom tank open so as to allow the marc to run away while the tank is being filled. A part of the vintage only is treated by diffusion in this case, and 1,400 kilos. may be treated per hour.

3rd. Drain a part of the vintage at the exit of the crusher, as we will hereafter explain, and after one hour's draining carry it into the

* P. Andrieux.—*Le vin et les vins de fruit*, p. 70. Paris, 1894.

tank. 1,600 to 1,800 kilos. of vintage may be treated per hour in this case. This mode of treatment gives the greatest yield.

Draining the Vintage. Draining Frames.—Drainage is necessary whether the white wine is made with white or red grapes. When the vintage is drained as it comes from the crusher, it yields from half to three-quarters of the juice it contains, in a colourless state. The vintage drained and treated by diffusion in the cold, yields a must slightly yellow in colour for white grapes, and more or less pink for red grapes.

The best arrangement for the drainage of fresh vintage is that devised by Coste-Floret.

The vintage coming from the crusher falls into a kind of cage composed of wooden frames put together with long bolts, the sides are made of wire netting of 1 cm. gauge. The wire netting offers a large surface of drainage.

The dimensions of the cages are 1·70 metres × 1·80 metres for the bottom, and the sides are 1 metre high. They contain about 2 cubic metres of vintage.

These cages are placed in a central trough 2 ms. × 1·50 ms., and 0·15 ms. in depth. They might also be placed on a cement flooring.

The must coming out of the troughs flows into the fermenting vats. Each cage may receive 6,000 kilos. of Aramon (a very juicy grape). Coste-Floret stems his vintage beforehand; if not, the weight would be a quarter or a fifth less.

With this system the drainage only takes place on the sides, and one hour after filling it is completed, the Aramon yielding about three-quarters of the juice it contains. This juice is very bright on account of the vintage acting as a filter. As soon as it comes out with a red tint the juice is received in another vat.

(To be continued.)

AMERICAN VINES.

By R. Dubois.

Vitis Berlandieri.*

(*a*) *Description* (*General Characters*).—Stump vigorous of creeping habit, trunk medium; wood of the year dull, with a few patches of woolly hair on the summits of the young shoots, of a cinnamon-brown grey colour, *with seven very distinct ribs;* tendrils discontinuous. Leaves, young: shining brownish-green; adult: medium, rounded pentagonal shape, nearly entire; petiolar sinus deep, with convergent lobes; scarcely indented; limb thick, wide honeycomb structure, folded along the mid-rib inwards, margins sometimes curved inwards; upper-face dark-green and shining; under-face lighter green, often shining, with prominent veins covered with short hair. Bunch medium, compact; berries small, very firm, spherical; skin black, covered with bloom. Seeds (Fig. 1) medium, squat; beak short and strong; chalaze rounded, slightly prominent, tapering to a scarcely protuberant raphe. Roots running, rather strong, thick and fleshy.

Fig. 1.—Seed of V. Berlandieri.

(*b*) *Varieties.*—The variations of forms of V. Berlandieri are very numerous, even more numerous than in the cases of V. Rupestris and V. Riparia. Between them there exists considerable differences, especially from the point of view of their vigour and adaptation, and, consequently, their cultural value, the only considerations which must be taken into account. These variations are the result of diverse natural phenomena, especially of their dissemination in very varied surroundings, and the natural selection which fixed their characters under these conditions. There are other variations which may be considered as individual or intrinsic, and these are shown in the various groups of the species by very marked differences of vigour in the same groups. Some have a feeble development which is a fixed individual character, and consequently transmissible by cuttings; these must be excluded from culture; only the vigorous forms in the various groups should be propagated. Finally, in a natural state other individual variations (rather than varieties, for they are not always reproduced as such by seed) besides vigour, facility of rooting from cuttings, fertility, are seen, which are possessed in a greater or less degree by certain Berlandieri types, variations which may be maintained by propagating from cuttings.

Selection is necessary and indispensable amongst the various forms of Berlandieri which have been introduced into France since 1887, and also those formerly obtained from seedlings. Perhaps it is premature, but in any case not useless, to attempt to define the forms that have been introduced and which appear to possess the greatest value. As a

* Extracted from *Les Vignes Americaines*, adaptation, culture, greffage, pépinieres, translated by R. Dubois and W. P. Wilkinson.

general fact, *the most vigorous*, without distinction of name, with very thick leaves, shining on both faces, with the extremities of the branches slightly tomentose, with golden-brown young leaves, are the most perfect; these are the characters of forms which, in the wild state, grow in the most calcareous soils.

The thickness of the tomentum divides the Berlandieri into two large but still connected groups, for the hairs are never entirely absent, even in the most glabrous forms. The *tomentose Berlandieri* have cobwebby hairs, especially on the young branches, on the principal ribs, and numerous stiff hairs on the sub-ribs. The leaves are large, 10 to 12 cm. (4 to 5 inches), dull under-face, goffered structure, sometimes thin. These varieties have occasionally cordiform leaves recalling V. Cinerea, of which they are without doubt hybrids, especially when the upper-face is finely goffered and dull, as also on the under-face. All these tomentose forms are peculiar to the rich and often siliceous soils, little calcareous and fresh, on the banks of rivers. Consequently they have no value for chalky soils. We will not attempt to characterize the forms of this group.

The less tomentose forms, which we will call, for distinction, *glabrous Berlandieri*, have smaller leaves, thicker, harder, and more or less folded inwards along the mid-rib, canes dark-tinted, with darker flutings; sometimes the fluffy hairs are only found on the summits of young branches, the short bushy hairs on the ribs and occasionally on the sub-ribs, on the under-face of the leaf, are often rather scarce.

In the second group of *glabrous Berlandieri* two subdivisions may again be established: 1st, those with leaves of a dull yellowish-grey on the under-face, comprising the least vigorous and least recommendable forms of Berlandieri; 2nd, those with very thick leaves, *dark-green and very shining* on the upper-face, and *shining yellowish-green* on the under-face, with short supple hairs on the ribs and sub-ribs. The varieties of this last group are the best and most vigorous for chalky soils.

Amongst these latter we will only indicate a certain number of forms; other better forms may, perhaps, be isolated by further selection. These forms, or rather groups of forms, have recently been studied and characterized in an important memoir, published by Marcel Mazade in the *Revue de Viticulture* (vol. V., 1896).* They are mostly of very great vigour and real value for reconstitution; their development equals that of the best varieties of Riparia. Mazade has isolated and selected most of these from forms introduced and cultivated in various French vineyards. Those which appear to us to have the greatest value in regard to their resistance to chlorosis are the forms belonging to group No. 2; the forms in groups Nos. 1 and 3 are very vigorous and of very great value, but they are, perhaps, a little inferior to the types of No. 2 (especially the *Berlandieri Millardet*).

* See Marcel Mazade.—*First Steps in Ampelography.* Translated by R. Dubois and W. Percy Wilkinson. Melbourne, 1900.

It is certain that an elimination will be carried out among the diverse forms which we cite, and we may already safely consider the *Berlandieri Millardet*, *Berlandieri Vialla*, and *Berlandieri École* as inferior to the others, and consequently not worth cultivation. We will only mention the *Berlandieri Planchon*, *Berlandieri de Grasset*, *Berlandieri Bouisset*, forms named by T. V. Munson, which are hybrids and not pure Berlandieris, and are without value for resistance to chlorosis, although very vigorous.

Herewith the way in which Mazade subdivides and fixes the distinctive character of the forms of Berlandieri actually known, taking into account the general characters which we have given for the species and which are common to all the forms, and also the general particularly distinctive characters for the whole of the most meritorious Berlandieris.

GROUP No. 1.—General colour, uniform light-green; wood light (clear rather brilliant hazel); leaves large, elongated, lateral sides often parallel, often rather regularly folded inwards along the mid-rib, sometimes flat, relatively thin, supple, and smooth; extremities

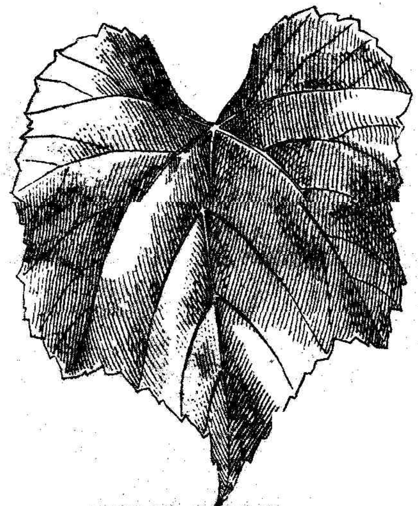


Fig. 2.—Leaf of Berlandieri Rességulier No. 1.

of the shoots ashy and light carmine; young leaves golden-yellow, passing gradually to the definitive tint; petiolar sinus straight V shape; group very slightly tomentose.

In this group we will mention:—

Berlandieri Mazade.—Very vigorous form, named and multiplied by Malègue; leaves very large, young leaves very slight carmine tint, the shoots and young leaves the least tomentose of the group.

Berlandieri Rességuier No. 1.—(Fig. 2 and Plate III.) having characters corresponding to those already given for the group; very vigorous form, with thick and long canes.

Berlandieri Daignère.—(Fig. 3.) This very vigorous form, like the preceding, is little different from No. 1, unless it is by its leaves, which are slightly revolute on the edges or inside.

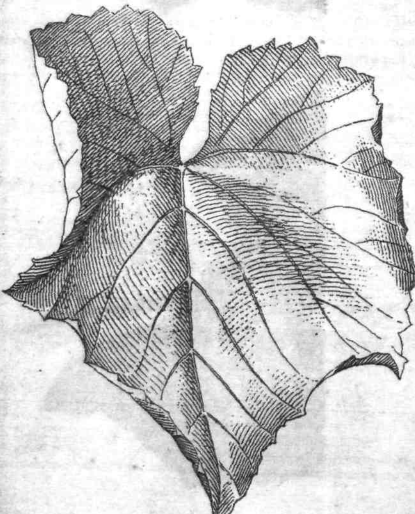
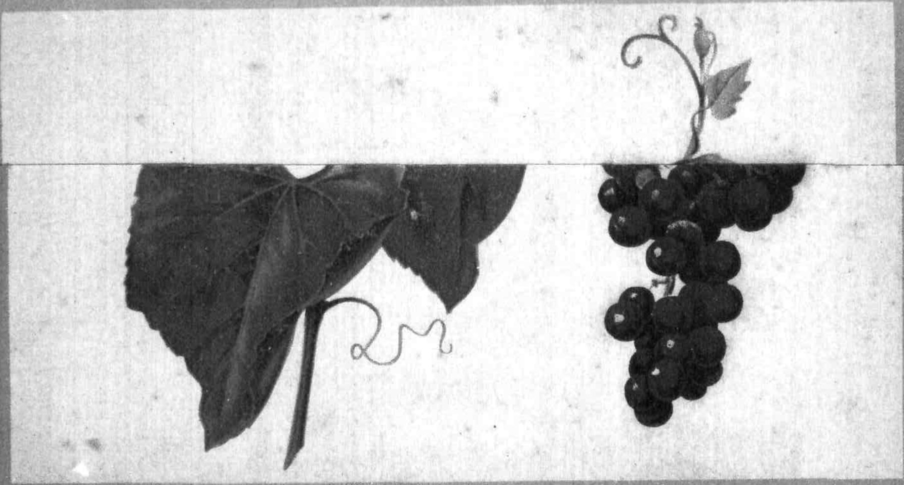


Fig. 3.—Leaf of Berlandieri Daignère.

Berlandieri Millardet.—Form isolated, and named by T. V. Munson. This group of Berlandieri has the smallest leaves and most carmine budding; the leaves are rather dull, the petiolar sinus very open, and the wood absolute ashy-grey.

PLATE III.



BERLANDIERI RESSEGUIER No. 1.

GROUP No. 2.—General colour very dark-green and very brilliant (varnished) appearance; wood hazel grey reddish, strongly striated and excoriated; leaves dark-green, brilliant, appearing varnished on the upper-face, rounded, thick, margin largely undulating, often folded conically; teeth very blunt; petiolar sinus lyre or U shaped, but variable; apex of the shoots whitish, slightly carmine; young leaves bronze violet-ashy colour, turning to a real bronze and passing suddenly to the definitive colour. Forms of this group rather tomentose.

We will only mention amongst them the *Berlandieri Rességuier No.* 2 (Fig. 4), which is one of the best for resisting chlorosis, and the *Berlandieri Cristal*, which is a form of great value.

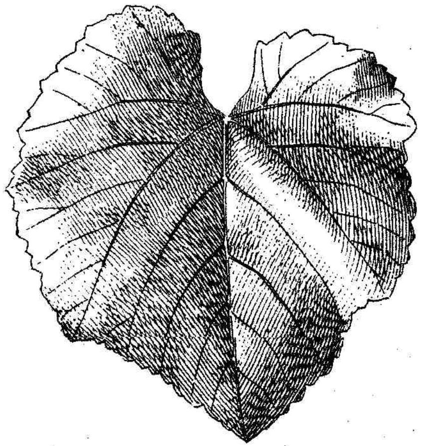


Fig. 4.—Leaf of Berlandieri Rességuier No. 2.

GROUP No. 3.—Leaves very large, more or less honey-combed in structure along the principal ribs, brilliant on both faces; ribs always reddish at the point of insertion on the upper-face; this colouration is prolonged half-way up the leaf; teeth very blunt; petiolar sinus nearly closed. Amongst them we will mention as one of the most vigorous, selected on the property of Madame Jules Robin, at Saint-Même, near Cognac, the *Berlandieri de Lafont No.* 9. This variety is of considerable vigour, and in resistance to chlorosis is second to no other variety.

GROUP No. 4.—Leaves relatively dull, ribs pale green and distinct on the limb; *indentations rather marked;* fluffy hairs rather numerous on the ribs of the upper face; budding yellowish white with carmine margin rather marked on the young leaves; wood rather red for a Berlandieri, this last item may lead to a belief of hybridization, although the leaves have the general characters of the species. The *Berlandieri d'Angeac* belongs to this group; *it* has withstood, *in* the Charentes, relatively strong calcareous soils. It is a very vigorous vine, with stout wood, and is a good grafting stock in soils very liable to cause chlorosis.

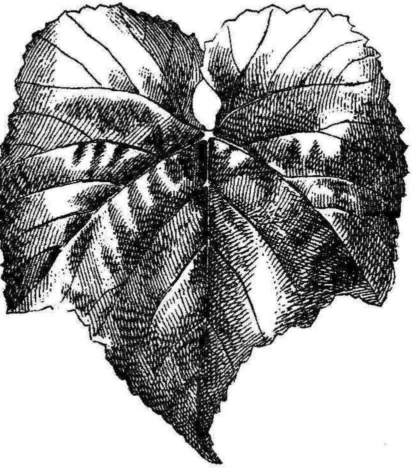


Fig. 5. - Leaf of Berlandieri Viala.

GROUP No. 5.—Adult leaves very large, rounded, uneven, thick, sinus nearly closed, young leaves extremely bronzed and brilliant. These forms are well characterized. Amongst them, we mention the *Berlandieri Viala* (Fig. 5), a form named and selected by T. V. Munson amongst the Berlandieris of the most chalky soils of Texas; it is less vigorous than those of Groups Nos. 1, 2, and 3. Certain forms of this group actually being studied in the Charentes seem to have a greater vigour than the above and will perhaps become of real value.

GROUP No. 6.—Adult leaves very characteristic; gondola shaped at the centre, strongly revolute inside on the margins. The Berlandieri of this group are mostly very inferior; amongst them we will mention *Berlandieri École* (Fig. 6).

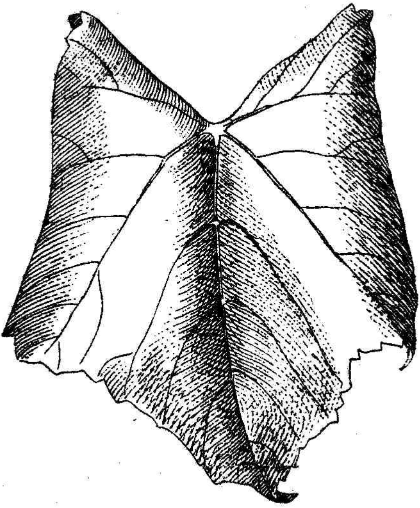


Fig. 6.—Leaf of Berlandieri Ecole.

(c) Adaptation and Culture.—The V. Berlandieri is a species belonging exclusively to the south of the United States. It grows south of the Brazos River, throughout the centre and south of Texas, in the south of New Mexico, and in the north of Mexico.

The forms of *Tomentose Berlandieri* are most frequent on the river banks. The forms of *glabrous Berlandieri* inhabit the hilly or mountainous regions of medium elevation belonging to the various strata of the lower *Cretacean;* the individuals of these forms are distributed in very great numbers on the sides and tops of hil's, where they resist extreme droughts, such as do not occur in the warm regions of the South of France. The temperature in Texas reaches 40° to 42° C. (104° to 108° F.) in summer. In the Missouri and Texas the Berlandieri has resisted cold of – 23° and – 28° C. (9·4° to 18·4° F.), without being damaged by the fall of temperature; by this it can support the temperature of our French regions and succeeds in both the

north and south of France, if only the influence of the climate is taken into account. It has not suffered from the cold in the Charentes, Rhône, and Maine-et-Loire.

Of all species of American vines, the Berlandieri is the most resistant to chlorosis, and succeeds best in the chalky limestones and white marls. It grows luxuriantly, in Texas, in soils belonging to the lower Cretaceous, which are rich in limestone, easily soluble in rain water. The soils there vary in fertility, but are always rather poor, they have a blackish colour similar to those of the Charentes, the calcareous fragments, mixed with the soil, which are produced by the displaced and decomposed rocks of the subsoil, are white and very soft. The subsoil is usually constituted of large fissured rocks, white and soft, with relatively scarce patches of siliceous nodules of various sizes, occasionally it is formed of laminated strata of very calcareous marl, bluish white, rather yellow. In these surroundings, the Berlandieri remains green and vigorous in very dry years, and also in very rainy springs.

In France, it had been noticed that the V. Berlandieri grew well in strongly calcareous soils ; at Dr. Davin's, for example, and in very chalky soil ; at J. E. Planchon's, in very calcareous quaternary tufa ; in the Charente-Inférieure, and in the *Groies* soils. Examples of the resistance of Berlandieri to chlorosis are actually numerous and conclusive. In the experimental fields of the chalky Champagne (*Champagne crayeuse*), near Cognac, it has maintained a fairly constant green appearance.

The soils of the Charentes have the following composition :—

Groie soils.—Soil light ; colour, ochreous or red, more or less dark, formed of 50 to 70 parts fine sand, and of 50 to 30 parts small angular calcareous fragments, having dimensions varying from 1 to 3 cm. ($\frac{1}{2}$ to $1\frac{1}{4}$ inch), and from 0·5 to 1 cm. ($\frac{1}{4}$ to $\frac{1}{2}$ inch) in thickness. The depth of this bed is from 15 to 25 cm. (6 to 10 inches). The subsoil is formed of calcareous fragments, larger, flattened, or of even dimensions on all sides (5 to 10 cm.). A little under the soil they are not numerous, nor mixed with organic matter ; they are decomposed outside, forming a yellowish marl, which covers them, and fills the interstices. Occasionally their decomposition is more complete. These soils are frequently met on the Jurassic and Cretaceous formations, and are found all over the Bourgogne.

The *strong groies* are more clayey. Under the soil, at a depth of 20 to 35 cm. (8 to 14 inches) they become marly.

Champagne Soils.—Dark grey or black vegetable soil, mixed with a small quantity of little fragments of limestone rock, soft, and easily broken by the hand; soil light and very friable, depth 15 to 35 cm. (6 to 14 inches). The subsoil is a chalky rock, friable or easily opening under the action of frosts. It is sometimes formed of irregular fragments, the interstices of which are filled, near the surface, with a vegetable soil; sometimes with layers 1 to 3 cm. ($\frac{1}{2}$ to $1\frac{1}{4}$ inch) thick, horizontally disposed; in the latter case the roots never penetrate to the subsoil.

The several analyses following, due to B. Chauzit, will show the amount of carbonate of lime in the chalky soils of Texas where the V. Berlandieri grows naturally, and also those where it has remained green in the Charentes:—

	Per cent.
Belton soil, Texas	96·42
,, subsoil	94·90
Temple soil, Texas, No. 1	76·10
,, ,, No. 2	51·51
Austin ,, ...	79·48
,, subsoil, Texas	90·65
Champagne soil, Julliac-le-Coq, Charente	43·60
,, subsoil ,, ,, ...	68·65
,, soil d'Angeac, Charente	56·37
,, subsoil ,, ,, ...	75·35
Cognac soil	48·55
,, subsoil	75·76
Genté soil	32·37
,, subsoil	56·48

On comparing these analyses, in reference to the carbonate of lime, with those of the chalky or marly regions of France, where no American vine has prospered, it will be seen that those soils contain an amount of carbonate of lime which is not higher than in the soils we have mentioned, and where the V. Berlandieri has remained green.

Herewith several analyses of soils from highly calcareous regions, according to Chauzit and Margottet, expressing their percentage of carbonate of lime:—

	Per cent.
Chevillon soil (Charente-Inférieure)	54·46
Montels ,, ,, ...	52·75
,, subsoil ,, ...	64·82
St. Jean-d'Angely ,, ...	59·55
,, subsoil ,, ...	67·80
Conteneuil, soil ,, ...	48·24
,, subsoil ,, ...	65·00
Vertus soil (Champagne-Marne)	52·53
,, subsoil ,, ...	64·90
d'Oger soil ,, ...	65·24
,, subsoil ,, ...	81·80
d'Avize, soil ,, ...	42·33
,, subsoil ,, ...	69·45
de Quassac soil (Gard)	59·72
d'Aubais ,, ,, ...	72·45
Villeveyrac ,, (Hérault)	54·65
Verchant ,, ,, ...	35·25
,, subsoil ,, ...	58·86
Leucate soil (Aude)	49·93
Aveyron soil ,, ...	52·00
Daix ,, (Côte-d'Or)	62·74
Beaune ,, ,, ...	31·65
,, subsoil ,, ...	56·69
Volnay soil (Fremiet)	31·66
,, subsoil ,, ...	42·11
Chassagne soil (Grand Clos)	62·[illegible]3
,, subsoil ,, ...	57·29
Sautenay soil (Chaissay)	36·77
,, subsoil ,, ...	60·96

The other species of vines which have been experimented with in the Cognac district, in the chalky soils of which we have given the analysis, became completely stunted. Contrary to the V. Berlandieri,

the Folle-Blanche, growing on its own roots, when planted in the same conditions as the V. Berlandieri, was not always exempt from chlorosis.

We have pointed out, in the first part, the fact that a number of American vines sometimes remained green in chalky soils, but rapidly turned yellow and died as soon as grafted. It was important that the question of the grafted Berlandieri in chalky soils should be resolved. Now it is done for most of the calcareous soils. Only one example had been observed in Texas, at Belton, where. in the very white, chalky, limestone soil, good varieties of Berlandieri had been planted in 1884, out of which a few vines were grafted in 1886; at the second leaf after the grafting, in 1887, the grafts remained very green and very vigorous, the canes were from 3 to 5 metres (10 to 16 feet) long.

At J. E. Planchon's, Berlandieri were planted in 1880, in soils partly *formed by the decomposition of the Quaternary tufa, rich in carbonate* of lime, and were grafted in 1882. They were planted amongst many other American grafting stocks, such as Riparia, Taylor, Solonis, Jacquez. Out of 30 grafted plants 25 have knitted, and the grafts are much more vigorous than those on the other grafting stocks. Besides, the trunk of the stock is more developed than that of the scion. At Bethmont's, in a bad *groie* soil, where over 600 varieties have been experimented upon, the Berlandieri alone has resisted. The grafts which are ten years old, become more and more vigorous, although they are grafted with Mataro, which is known to do very badly on American vines. In the experimental fields of the Viticultural Station of Cognac, in very chalky soils, the grafts on good varieties of the Berlandieri have remained green and vigorous.

Important reconstitutions with grafted Berlandieri have been made in the *Charentes;* these grafts which are actually eleven and twelve years old, have always remained green and vigorous in a calcareous soil where the Solonis, Jacquez, &c., grafted with the same varieties, turned yellow and died. At the School of Agriculture, Montpellier, the Berlandieri Nos. 1 and 2, grafted with Carignane since four years, are of an excessive vigour and very great fertility in a soil particularly liable to cause chlorosis, and where no other grafting stock has lived, not even the Franco-American hybrids. At the same time a fact of the greatest interest has been remarked. The grafted Berlandieri have never shown a trace of chlorosis, while the Berlandieri No. 1, on its own roots, of the same age, planted next to the grafted vines, turned yellow. These neat and conclusive facts, confirmed by other results of the same nature, prove that the grafts, contrary to what has happened to most of the other grafting stocks, do not diminish to a notable degree the power of resistance of the Berlandieri to chlorosis. And it forces us to the conclusion that, in soils conducive to chlorosis, the reconstitution should be made with rooted grafts. As the grafted cuttings of Berlandieri succeed as well as the freely-rooting grafting stocks (as we shall see later on), the reconstitution by this species in most of the chalky and marly soils seems actually certain.

The Berlandieri therefore resists chlorosis after grafting, and, if exceptionally, chlorosis appears at the first or second year in the most calcareous soils, it is only transient and of no importance, and as we

have already pointed out in the first part, it does not become manifest after the fourth year. But it is absolutely necessary, and we insist on this point, that Berlandieri stocks be selected of the greatest vigour. The failures resulting in certain districts from slender, slightly vigorous Berlandieris were foreseen ; this, however, does not minimize the value of the vigorous forms of this species for chalky soils.

The V. Berlandieri is a remarkable species for its grafting facility, and for the productivity of the grafts which it carries. Several European vines have been tried on it—Carignane, Aramon, Aspiran, Folle-Blanche, Cabernets, Merlot, Cinsaut, Pinot, &c.—and have all done well. No difference in size between the stock and the scion has been produced. Thus, at J. E. Planchon's, the Berlandieri planted in soils of the Quaternary tufa in 1880, grafted in 1882 with various varieties, had, in 1895, a very great vigour, and the stock had a larger diameter than the scion. It is the same at Mas de las Sorres, where the oldest grafted Berlandieris exist in rich slightly calcareous soils (grafted for nineteen years on two year old stocks), and which are of all the grafted American vines giving the greatest yield for the same scion. The same again is observed at Macquin's, Saint-Émilion, in the environs of Cognac, at the School of Agriculture, Montpellier ; at Verneuil's in the *Grande Champagne* of Cognac. Frappin's of Segonzac, &c. From the points of view of perfection of knitting, affinity, and fine growth and fructification of the grafts, the Berlandieri is a remarkable grafting stock. The earliness of the maturity of the grafts on Berlandieri is comparable at Las Sorres and at the School of Agriculture, Montpellier, to those of Riparia grafts.

Most of the varieties of V. Berlandieri have the drawback of not growing from cuttings. And it is to be noted that the most vigorous forms with types of character adapted to the calcareous soils, are those most difficult to grow from cuttings.

The resistance to phylloxera and superiority of resistance to chlorosis of the Berlandieri are actually without doubt, but the difficulty of multiplying the grafting stock would seem to render it of no use for reconstitution in chalky soils. This difficulty of multiplication is fortunately actually resolved beyond all doubt, the selection and isolation of the vigorous forms are definitely completed, and the utilization of the Berlandieri is now as common a practice as of the Rupestris and Riparia. Without actually entering into details, which will be explained later on, we will state that grafted cuttings of Berlandieri do, under the ordinary conditions, in well-conducted nurseries, root as freely as the grafted cuttings of Rupestris and Riparia. For several successive years the average strike of grafts (first choice) has been 50 per cent. at the School of Agriculture, Montpellier, and in various nurseries. When in possession of Berlandieri wood it is easy to obtain rooted-grafts ; and this is possible in the most northerly as well as the meridional regions of France, for, at Thomery (near Paris), Salomon has obtained 40 per cent. of good grafts with grafted cuttings of Berlandieri, as much as with the Riparia, and more than with the Franco-American hybrids of Rupestris. Besides, the grafted cuttings of Berlandieri are quite as

well knitted as those obtained on most other grafting stocks. As it is not advantageous to reconstitute in calcareous soils with any but rooted grafts, and as these are easily obtained from Berlandieri wood, the utilization of this variety does not offer any considerable difficulty.

The only difficulty consists in having the Berlandieri wood to make the grafted cuttings. This difficulty is easily resolved by several very practical processes. The best, in our opinion, consists in grafting at a couple of inches under the soil on Riparia, Rupestris, or even European vines, the cuttings of selected Berlandieri (*No. 2, No. 1, Anjeac, Daignère*, &c.). Berlandieris knit very freely. English-cleft, whip-tongue, and side-cleft grafts are made according to the size of the stock. Generally, under these conditions, roots grow at the joint, but they give rapidly, in the first year after the grafting, good wood, and quantities of cuttings, which are annually utilized for grafting stocks.

To obtain mother stocks, the summer and autumn layerings may be had recourse to, or the *bouturage en pousse*;* but the process of grafting the Berlandieri on already grown vines (Rupestris, Riparia, and V. Vinifera) seems to us the most economical and practical, in order to procure, in quantity, the wood necessary to prepare grafted cuttings.

Its special and unique properties of adaptation to very bad chalky soils makes the V. Berlandieri (or its Americo-American hybrids) the only species permitting the reconstitution of the soft, white, calcareous, chalky soils, where all other American vines have succumbed. And when the supply of Berlandieri cuttings becomes plentiful, it will permit the reconstitution of all the doubtful soils, where many grafting stocks have not given satisfaction, and where reconstitution has been considered impossible, such as the Quaternary calcareous tufa of the South of France, the yellow and white marls, the lacustrine calcareous soils of the Eocene and Miocene, the chalky soils of the Cretaceous, the *groies* soils of the Jurassic of the Charentes, of Vendée, Dordogne, Saumurois; the Cretaceous chalks of Champagne (Marne), Yonne, Aube, &c.; the white marls of the Oolithic, Bathonian and Jurassic of the Côte-d'Or; of various chalky formations proceeding often from calcareous sources, and appertaining to the diverse geological formations of different regions.

But it must not be thought that the V. Berlandieri, on account of its resistance to chlorosis, and on account of its thick roots, should be preferred to other well-known meritorious grafting stocks, for clay-siliceous, siliceous, or clayey soils.

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* Investigations made during the last five years, on the propagation of Berlandieris by ordinary cuttings, have resulted in definite success, and the use of Berlandieri has been *rendered quite as easy as that of Riparia or Rupestris, specially in hot countries* like Australia. Millions of cuttings have been planted in the Pyrénées Orientales during the last five years, and the percentage of strike was always as high as with Riparia (from 60 to 80 per cent.).

To obtain these results, it suffices in practice to gather the cuttings from at least four or five years old stocks, and to take only those well lignified. Further, and this is essential, they must be planted in a nursery, directly after the fall of the leaves, that is to say, in autumn, and not in spring, as is usually done. In a word, very early plantation must be performed; *the nurseries must be watered and well attended to*, and if these precautions are observed Berlandieris may be easily and practically propagated from cuttings. In 1900, 1,800,000 cuttings were planted, the average strike varying between 60 and
(P.V. 1900.)

SEASONABLE WORK IN THE CELLAR AND VINEYARD

By R. Dubois, B.Sc., F.C.S.

FEBRUARY.

Cellar.

Overhaul cellar material (casks, vats, presses, crushers, elevators, coolers, pumps, hose, &c.) and get ready for the vintage, which as a rule begins towards the last week in February in the northern districts, and the second week in March south of the Dividing Range. It is advisable to whitewash the walls of the fermenting-house with newly slaked lime.

Bottling should be finished before the middle of this month, as a slight fermentation is always noticeable in old wines at this time of the year, which corresponds to a revival in the growth of the vine. Watch very carefully young wines, specially those weak in spirit, as they often turn very quickly and become acetic at this particular period of the year if they have not been previously sterilized. If any sign of disease is detected, they should be at once racked in sulphured casks.

Open the cellar doors at night, and keep them closed during the day. As far as possible wines should not be despatched during this hot month.

Vineyard.

South of the Dividing Range.—Give a second topping and clear the leaves from around the bunches, if they show signs of not ripening easily. Third treatment against mildew and anthracnosis if required.

North of the Dividing Range.—Give a third scarifying to the vineyards, in preference after a rainfall. Tie those shoots which have been loosened by the wind. Attend to the grafts towards the middle of the month.

HINTS FOR THE VINTAGE.

By R. Dubois, B.Sc., F.C.S.

WHEN ARE WE TO BEGIN WINE-MAKING?

The answer to this inquiry is of the greatest importance, as it is towards the end of this month that the grapes are to be gathered for wine-making, and as we all know, the time of vintage has a great influence on the quality of the resulting wine.

We propose showing the means of determining the proper degree of ripeness, that is to say, the sugar and acid strength and the advantages to be derived from gathering the grapes at a peculiar stage.

The appearance of the berries and stalks, or the taste, may serve as a guide, but these lack in accuracy, and it is preferable to use special instruments, which are, fortunately, simple and easily employed.

DETERMINATION OF SUGAR.

Several mustimetres (Beaumé, Guyot, Hunter River) or densimetres (Babo, Salleron, Gay-Lussac) are used for this purpose. According to Roos: "It is necessary in order to determine the moment of perfect maturity to rapidly test the stationary state of the saccharine (sugar) weight; for this purpose any densimetre correct or not may be used, provided the same instrument is used for each trial."*

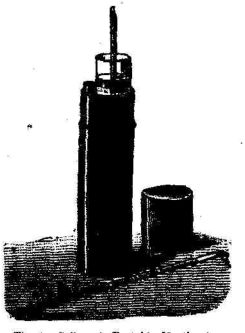


Fig. 1.—Salleron's Portable Mustimetre.

We prefer the densimetre of Gay-Lussac † (Fig. 1), which is used to ascertain the specific gravity of the must (or, in other words, the weight in grammes of one litre of the must experimented upon).

The specific gravity tests should be made as accurately as possible, and it is important that the samples of grapes should represent the average of the whole vineyard. With this object one should proceed with the work as follows:—

1. Select on the vineyard a certain number of plants, which will represent the average of the whole vineyard, and drive at the foot of each of these selected vines a long stake, easily seen from a distance. The samples of grapes should be taken from these vines only.

2. Take samples every three days, then every other day, then every day, beginning about twenty days before the time at which the vintage is usually started in the district.

* See *Wine-making in Hot Climates*, translated by R. Dubois and W. Percy Wilkinson, page 36 and *seq.*

† This instrument, also known under the name of *Salleron's mustimetre*, is sold, together with the tables, by J. Dujardin, 24 Rue Paveé, Paris.

3. Take the samples in the following manner:—Cut with scissors *from each of the selected plants, and from several bunches on each* plant, a few berries placed in different positions, *i.e.*, differently exposed to the sun's rays. 2 lbs. or 3 lbs. of grapes are required.

4. Take this sample to the cellar, crush it thoroughly with your hands, collecting the juice (must) in a basin. Pour the must in a bottle, let it settle a while. When the thick part has settled at the bottom, carefully decant the bright part in the test-glass and place the mustimetre in it. For the rest of the operation follow the instructions which are sold with each mustimetre. The figures indicating the specific gravity are proportional to the sugar strength.* For the sake of illustration, we shall quote the following example from Coste-Floret,† altering the dates of sampling to suit the Victorian season.

Date of Sampling.		Specific Gravity of Juice.	Approximate Weight of Sugar per litre.	Probable Strength of Wine.	
				Per cent. in Volume.	Per cent. Proof Spirit.
6 February	...	1·050	103 grammes	6	10·47
9 "	...	1·052	108 "	6·4	11·21
12 "	...	1·054	114 "	6·7	11·76
15 "	...	1·057	122 "	7·2	12·32
17 "	...	1·059	127 "	7·5	13·12
19 "	...	1·062	135 "	8	14·02
21 "	...	1·066	146 "	8·6	15·06
22 "	...	1·068	151 "	8·8	15·42
23 "	...	1·072	162 "	9·5	15·85
24 "	...	1·075	170 "	10	17·52
25 "	...	1·075	170 "	10	17·52
26 "	...	1·075	170 "	10	17·52

As from the 24th to the 26th of February the specific gravity does not vary, or varies but very slightly, we conclude that we may start the vintage. It is during the few days previous to perfect maturity that the sugar increases most rapidly. For instance, if in this case we gathered the grapes on the 21st instead of the 24th, we would make wine of 15·06 instead of 17·52 per cent. proof spirit, thus losing nearly 2½ degrees of spirit. However, in large vineyards the fear of rain, and sometimes the want of labour, which would result in over-maturation, often forces the proprietor to begin the vintage before the grapes are properly ripe. As pointed out by Roos,‡ this is not always a disadvantage. "General observations have shown that early vintages ferment well, and that the resulting wines are judged more favorably by expert tasters."

Determination of Acidity.

As the berries ripen, the acidity decreases. If the grapes are gathered before perfect maturity, the wine will be more acid and

* Large vineyards should be divided in several sections of 10 to 15 acres each and according to varieties, each section being sampled separately. The vintage would start from the section which ripens first.

† P. Coste-Floret, *Procédés modernes de Vinification*, Montpellier, 1894.

‡ *Wine-making in Hot Climates*, p. 45.

deficient in spirit, will take more time to mature, and always retain a sharp fresh taste (what is known as the *sève* of the French, the *abboccato* of the Italians, or the *Göhr* of the Germans). In Victoria, if we wait till complete maturity is reached, we shall generally have musts deficient in acid (especially in the warmer districts of the Murray), which will not ferment easily, and will often "*stick*," and develop diseases due to micro-organisms always existing on the berries, and brought to the vat at vintage time. These micro-organisms would not develop if the must were sufficiently acid. It is possible to remedy a deficiency of acidity in a must which has become overripe, and still make wine of sound qualities, yielding its maximum of alcoholic strength.

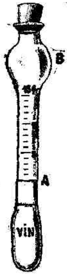


Fig. 2. Acidimetric Tube, Dujardin.

But to do this the wine-maker must be able to *ascertain the acid strength of his must*. This is done very easily with the simple acidimetric tube of Dujardin (Fig. 2), a solution of phenolphtalein and a titrated alkaline solution. Any chemist can prepare the alkaline solution in the following manner :—

"One litre of the alkaline solution should contain 8·17 grammes of pure caustic soda (Na HO), or 11·49 of pure caustic potash (K HO)." One cubic centimetre of this solution (or one division of the tube) corresponds to 1 gramme of sulphuric acid per litre.

The phenolphtalein should be in alcoholic solution at 1 per cent. Having these two solutions ready, one operates in the following way :—

1. Take from the fermenting vat, with the test-glass, a portion of bright must, pour carefully into the acidimetric tube up to the division A, adjust the liquid with a pipette.

2. If operating on white must, add two drops of phenolphtalein.

3. Pour in carefully, and in small quantity, the alkaline solution. A rosy tint appears, which disappears on shaking. Add the alkaline solution in successive small portions, till the last drop colours the solution a permanent *rose* tint. In the case of red must there is no need to add any phenolphtalein, a greenish colour marks the completion of the reaction.

4. The acid strength of the must is obtained by reading the number of the division opposite the level of the liquid in the tube. If the must does not reach 4 or 5 grammes of acid per litre, it is advisable to add tartaric acid to the vat in proportions varying between 35 and 150 grammes per hectolitre (24·55 to 105·2 grains per gallon). Place the tartaric acid crystals into a bucket. Siphon some must from the vat into the bucket and pump the must from the bucket into the vat. When the crystals are completely dissolved the operation is terminated. The tartaric acid disappears in the fermenting must to form bitartrate of potash, but other acids of the wine are set free. We would urge those who are about to make wine to read the third chapter of *Wine-making in Hot Climates*, where they will find a clear statement of the whole question.

(To be continued.)

HORTICULTURAL BRANCH.

QUALITY IN FRUIT.

By C. Bogue Luffmann.

The smallness of local and adjacent populations, the remoteness and expense of packing and transit to foreign markets, combined with the comparatively high price of labour and material, compel the Victorian fruit-grower to work for a high standard of excellence in all he cultivates. In spite of the efforts of horticultural and fruit-growing associations and exhibitions, very little is known regarding the making of quality. Standards are impossible when no comparison can be made; hence, few realize how inferior is their fruit in size, colour, flavour, and keeping qualities. Here and there excellent samples are regularly produced, but the vast bulk is wofully below the standard which can command a ready sale at a paying price. The common causes of inferiority are not a few, but as regards flavour it is largely due to the trees being placed in impossible soils and climates. Climate plays a much more important part in this matter than the soil ingredients of themselves. The dryness of the atmosphere whilst the majority of our fruits are developing and ripening acts seriously against their perfect maturation. A dry air is particularly objectionable to apples, pears, plums, cherries, and all the bush fruits. Peaches can do in a somewhat dry atmosphere, but where it becomes really dry and remains so for weeks or months, no fruit of fine flavour will be produced. Apricots, figs, and the grape in all its forms, will attain to good size and quality in the driest districts, providing the moisture of spring and early summer is equal to swelling them to a good size; but, as a general rule, full and distinctive flavours come out in greatest perfection where the atmosphere is moist rather than dry. In a casual way all observe the difference of the temperature of the soil and the air during the various periods of summer. The skilful cultivator will do all he can to balance these in accord with the nature and needs of his subjects. Those who have eaten fruit grown under glass are aware of the exquisite flavour of every particle of flesh within the skin. This is due not so much to the preparation of the soil and limitation of the root-range as to the roots and leaves being entirely under the control of the gardener, who gives or denies air of varying temperatures and degrees of moisture. He also provides screens from the hot sun, excludes hardening, drying, and chilly winds, and all such elements and enemies as work injury to leaves and fruit. He also takes off leaves or encourages more, so as to regulate the volume and quality of the sap. In brief, everything that would coarsen and make irregular is shut out, and everything that will insure the perfection of size, colour, form, substance, and flavour are systematically striven for. Our open-air conditions offer the widest contrasts to those obtaining in the orchard-house, but we should not lose sight of the object-lesson provided.

For yielding fruit of high quality, next to glass houses come walls, then terraces or rocky hill-sides, since both of them afford the chance to control the water supply and provide moist or dry air for the leaves and fruit. We are well-nigh powerless to affect the temperature or degree of moisture of the atmosphere on broad and open areas such as have been most commonly chosen for orchard sites. If our ideals could be realized we should have positions and conditions which would admit of our "turning on" hot or cold, dry or moist air, according as we want leaves and fruit to grow or ripen. In all circumstances we should know the feeding, the growing, and the ripening season for roots, and leaves, and flowers, and fruit, and wood.

Few but are familiar with the extraordinary difference in the quality of fruits grown in different climates. The pears of Gippsland are better than those grown in warmer and drier districts. It is not the soil proper, but the difference in its condition, and that of the surrounding atmosphere, which is responsible for this superior quality. Apples in the north, or in any hot and shallow soils, are of inferior quality chiefly because they do not get sufficient elaborated sap through the agency of one set of leaves, but depend on two or three imperfect growths, none of which mature sufficiently to assist the fruit in its final stages of absorption.

The peach tree will endure a high temperature and some degree of drought, but under such circumstances its fruit will always be inferior. Seldom, indeed, do we meet with a peach which from a European standard may be judged even second class. Our fruit is undersized, unequally formed as regards the nature of its flesh throughout—thus there are green, bitter, and hard parts when the face or upper side is ripe unto decay. This is commonly due to irregular feeding and unnatural heat and dryness of air, forcing maturation in one part before the general body of the fruit has been fully supplied with elaborated sap.

And where fruit ripens evenly, fine flavour is usually lacking, as where the roots are sending up an abundance of crude sap (too often little more than water, through the poverty of the soil), a flavourless and sloppy mass is the result. The green, turnipy, and mushy peaches are incapable of bringing a good price.

Early plums are usually without flavour, owing chiefly to their ripening whilst the bulk of the sap is in a crude condition; whilst in hot districts, where the air is dry, plums coming in at a dry season are usually of low grade as regards quality. Plums, like apples, often lose their first crop of leaves through drought or scorching, and the second growth is so poor as to be quite incapable of nourishing the growing and ripening fruit in the best manner.

It is often stated that local strawberries are not equal in flavour to those grown in the old land, which is quite true, and with good reason. A moist heat is necessary to the development of the strawberry, one or two dry clear days being sufficient to endow it with a fine colour, substance, and flavour.

All variations in size, quality, keeping powers, and general appearance are, apart from distinctive habits of varieties, the outcome of

climate acting on the food supply, and man's attention or neglect at different seasons. Moist air is of the greatest benefit to soft skinned and sensitive fruit. Moist air should, as far as possible, prevail until the fruit is fully grown. Dry air is needed to ripen a percentage of the leaves, especially those near the fruit, when it is the season for gathering. Fruit taken from trees when all the leaves are green and unfinished, is ever inferior.

A good appearance is, of course, a great aid to the sale of fruit, but fine flavour is after all the only thing which will find and secure a permanent market ; as it compels those who discover it to become regular purchasers.

Of course, where trees are planted in radically wrong positions, little or no improvement can be hoped for ; but a great deal can be done in the way of improved methods of cultivating, soil dressing, and pruning, towards raising the standard of excellence in our fruit.

Placed as we are, little and good will prove of greater value than heavy quantities of inferior stuff. The finer the quality, the greater the keeping power, hence the marketing season can be prolonged, and gluts to a great extent avoided. Even for preserving, the finest fruit is necessary, as no flavour obtains in such as are made from green or badly nourished samples. Most stone fruits are losing their vitality, and it is high time that some species—especially peaches—were introduced from vital seedling stock, which are best able to bear up against hard natural conditions and the presence of insects and disease.

STUDIES IN THE ORCHARD AND GARDEN.

By C. Bogue Luffmann.

I. Length of valuable life of fruiting wood.
II. Primitive pruning methods.
III. As roots feed.
IV. Fertilizing figs.
V. The movements of roots.
VI. The healing of wounds.
VII. The importance of bark.
VIII. Imported fruits.
IX. Influence of the seasons on fruit and the fruit trade.
X. The variable quality of wood.

Length of Valuable Life of Fruiting Wood.

The length of valuable life of fruiting wood of a given substance varies greatly in different species, kinds of soil, and climate. As a general rule, wood lasts much longer in cool than in hot regions. For example, a light branch of a pear tree may prove useful for thirty or forty years in a cool region, whereas the same branch would be hardened, desiccated, and exhausted in five to ten years in a hot district such as the Wimmera.

Pear, plum, apple and cherry wood are all capable of yielding good fruit over many years where the climate and soil are favorable, but apricots and peaches exhaust their light wood in a very short time, no matter where they may be grown.

It should never be forgotten that fruit produced on young wood—and where a clear way exists for the circulation of the sap—is always superior to that borne on old, gnarled, and exhausted wood. This is one of the important objects of pruning—to promote new wood for future crops, to keep up the size of leaves, to quicken and extend the action of roots, and thereby increase the volume and quality of the sap, which naturally has a tendency to decline in value after trees come into bearing.

Primitive Pruning Methods.

Many curious and primitive customs still obtain as means to secure fruitfulness in trees. The wild cherries of Europe are a great harbor for birds, and in the days of the blunderbus and flintlock it was found that by shooting at birds, and consequent "peppering" of the trunks and main branches of trees, they were induced to send out side shoots and prove much more fruitful. Hence the shooting of trees became a common practice, and is by no means an obsolete custom. In still earlier times it was discovered that the driving of nails and old iron into the heavy wood of trees was more conducive to fruitfulness than the puncturing of the bark by lead shot. In each case the first effect was the same, as the wounds caused an outward flow of sap, which retained sufficient life when exposed to the air and light to generate buds and furnish forth shoots. But iron also promoted a rusting and consequent increase in the size of the wounds, so that the sap was regularly checked in its upward and downward flow; hence the large

amount of elaborated sap eventually stored in the head tended to decrease the size of the leaves, reduce root action, and render the tree more fruitful. From time immemorial it has been the custom to *bring young olives and other robust and impotent trees into bearing* by beating their branches during spring or autumn, and in the language of all peoples it is probable that a couplet will be found which agrees with our own that—

> *A wife, a dog, and a walnut tree,*
> The more you beat 'em, the better they be.

We learn from all crude methods the philosophy of true culture. Man, in imitating such accidents as resulted favorably, has furnished *the key to saner and surer practice ; so that now, instead of using* the shotgun, the driving of nails into, or the hanging of old iron and huge stones in the forks and branches of trees, we can conceive designs and prune to such form and substance as will bring a degree of vigour and quality such as the accident produced. And with this rare difference, that the tree is not thrown into a condition of disease and premature decay, nor is it made irregular in form or fruiting. The pruning season will soon be round once more. How many orchardists will, ere it arrives, seriously consider the actual nature and needs of the subjects they are called upon to manage, and work for an improvement in this important field?

As Roots Feed.

A plant feeding in a soil temperature varying, let us say, between 60 and 80 deg. Fahr., will not take an equal proportion of properties from the soil, nor employ them in making sap, or leaves, or fruit of a unform quality.

Very clear proot of this may be seen when a crop of fruit ripens over a long period on a given tree. The first to ripen will usually be very inferior to that which comes in when more heat is operating. The last fruit will differ from the earliest and midseason, though the climate will determine which of the three divisions has most quality. In any case, some period has been more favorable to root feeding than others, and this should show the right temperature, substance of bearing wood, and general conditions of the soil to be desired. Different temperatures make some ingredients of the soil more available than others. Digestion is affected by heat, and the digestibility of the food taken determines the nature and quality of the wood and fruit provided. Thus we have good, bad, and indifferent fruit in one year *from a uniform soil and age of tree or plant. Only the feeding tem*peratures have been different, and these have restricted or made free all the possibilities of the soil. We should know approximately the temperature and degree of moisture in soil which makes for the best *form of root, wood, and fruit growth.*

Fertilizing Figs.

Several years ago the present writer issued a pamphlet on this subject, since which time many "opinions" have been set forth as to

the wisdom or necessity for artificial fertilization. Recent experiments have at last convinced the Californians that caprification is not a mere superstition. The finest of autumn figs are infertile, and therefore incapable of drying into a good article of diet. The pollen of the male or capri fig changes all this. but the eye of the fruit-bearing fig does not admit of the pollen being borne in through the agency of the air. Hence a little fly—the Cynip, or *Psenes Blastophagus*—is employed as pollen carrier.

Doubtless the Americans will now move actively in the matter, and we may look to them to supply us with varieties of fig which the Syrians, Greeks and Turks have carefully endeavoured to prevent going out of their territories. The fig industry is one which is bound to take its place in many parts of Australia. Victoria has a large slice of good country in the north and north-west, and a population anxious to be supplied with a good article, for which it will give a distinctly paying price. As soon as the Americans get beyond the purely experimental stage we shall be safe in taking up this business in real earnest.

The Movements of Roots.

Roots are credited with the instinct to reach out and possess themselves of any valuable food deposit which may exist afar off, and where no line of continuous attraction is apparent. This is not really true. There is always a predisposing cause, or a series of causes. The fact that a root will run direct to a solid wall is in no sense remarkable when we consider the attraction which the wall offers and impresses on the surrounding soil. More heat, air, and moisture surround the masonry. and in laying its foundation a large mass of soil was disturbed, and probably much improved by the handling it received. Roots are literally led by trails of food, and by moving on the lines of least resistance, and where the greatest volume of food is available. Hence they creep up drains, run over the skeletons of buried animals, follow the courses of former roots long dead, squirm through crevices and rents in walls, fill the spaces where air is most abundant under pavements, and crop up in numberless odd situations, but never without traces of the means which propelled them along their entire course.

The Healing of Wounds.

Wounds may heal so long as the sap is circulating, but most readily during the late spring and early autumn. Cold and wet, as well as great heat and drought, act against the movement of the sap, and in its absence the bark on the sides of wounds is liable to be killed.

Keep wounds clean and smooth if you would have them heal over. Apply no mineral poisons, such as red or white lead, or ordinary wood paint. Vegetable oils, lard, or other animal fat, or grafting wax, will serve to keep out damp and disease germs, toadstools, insects, and extremes of heat and cold ; so that any sap brought to the margin of wounds will remain alive to formulate new bark.

The Importance of Bark.

Beyond acting as a support, wood is not actually necessary to the life of bark and leaves. Any cylinder of bark from which the wood has been skilfully removed will, *if its sides are carefully closed against* air, go on growing and deposit new layers in its inside until a centre of solid new wood is formed. This applies only to exogenous trees, or such as increase their diameter by depositing new layers on their exterior. Such are all our fruit trees, and when it is realized that the entire life of the superstructure is wrapped up in the bark, the need for careful and systematic attention to this substance is not to be over-estimated.

Imported Fruit.

The drying, canning, pickling, and making of sweet preserves of fruit should be much more generally practised than at present. The following forms of orchard and garden produce are still largely imported—all of which can be well grown and prepared in the various districts of the State:—

Walnuts, pickled and fresh.
Almonds.
Filberts.
Cob, and Hazel Nuts.
Chestnuts.
Pickles of many kinds.
Apricots in bottles.
Canned Pears, Peaches, Apricots. Cherries, Gooseberries, and Currants.
Prunes.
Figs.
Orange Marmalade.
Jams, Jellies, Syrups, and Vinegars from various fruits.
Lemons, fresh, and as candied peel.
Raisins.
Muscatels.
Currants.
Sultanas.

This is a very formidable list, which involves the sending abroad of enormous sums annually.

Influence of the Seasons on Fruit and the Fruit Trade.

Cool summers are favorable to the growth of apples, pears cherries, plums, and the bush fruits, but they act seriously against *the sale of early summer fruits, such as peaches and apricots,* and also delay the ripening, and decrease the quality and value of table grapes.

The present summer must be regarded as unusually favorable to wood growth, which in its turn will become useful for fruit bearing.

The Variable Quality of Wood.

Light wood springing directly from the trunks of strong trees is not, as a rule, able to bear fruit, unless the tree be old and bark-bound.

This is owing to ripe sap being confined almost entirely to the extremities, where light, heat, and air admit of proper leaf development.

Shoots appearing low down derive their sustenance chiefly from the crude sap of the roots, and where leaves have the smallest chance to perfect themselves.

THE ORCHARD.

Next year's crop of flower buds is now in sight, and excepting the northern districts, no means exist for adding to their number during the remainder of this summer. It will be possible to affect the quality of buds either by over or underfeeding. In the one case they will run to wood, and in the other be so imperfectly developed that they will drop prematurely or appear as impotent flowers.

The pinching of the points of shoots during this month should only be done by those who thoroughly understand the nature of the trees and the effect of local climate.

Where points are pinched and a rush of sap occurs about a ripened bud, it changes its nature, and is temporarily or eternally spoiled for fruit bearing. The volume, quality, and activity of the sap determine the nature of buds; thus they are woody or fruitful according to the amount of crude or ripe sap returned from the leaf to the bark. As the different parts of a tree are of different ages, and variously fed, so does the sap vary in character and flavour. Root sap is sweet, or at most only astringent—leaf sap is bitter; small branches have bitter bark in spring or whenever growth is active, but it and the leaves become sweet and almost fruity in flavour towards autumn. Heavy trunk bark is usually very astringent and always most so on the shady side. To understand trees one must get inside them, and see how they work, and make the various deposits which lead to such exterior forms as we know as bark, and leaves, and flowers, and fruit.

Old bark being hard, it compels a slow circulation of the sap, and thus longer exposure to the direct influences of solar heat, air, and light tend to change it more completely than where it returns rapidly to the root, as in the case of a young and vigorous tree. Rapid circulation of the sap ever means wood growth. Slow circulation—literally the locking up of perfectly formed sap in so far as good soil is drawn upon—plus heat, air, and, light, makes for fruit forming elements.

In practice an even balance must be maintained, as a preponderating root system means a rank fruitless tree, whilst slow circulation, long maintained, tends to overcropping and early exhaustion of all the wood.

In the far north keep trees growing till the end of this month, otherwise they will be in danger of having their wood too much exposed to the late summer sun. This exposure would of course prove helpful to very strong trees, but distinctly injurious to weakly ones.

In the hurry of harvesting and marketing, the orchard is often seriously neglected. It must not be forgotten that at the season when the fruit is being gathered in, the wood must be formed for next season's crop. Where a crop is light, and trees strong, there is no occasion to cultivate in the late summer, but perfect cleanliness must be observed, and the fullest opportunity afforded to all leaves and light wood that it may develop and ripen

before winter. February is about the best month for budding fruit trees, though the period depends much on local climate. The mechanical operation of budding is very simple, but some practice is necessary in order to make neat and safe unions of bud and stock. Before budding, one requires to know why it is done, and the various influences and conditions which go to make the work successful or otherwise. Budding is done to perpetuate certain types of fruit which would not come true from seed ; also to change a tree from one variety to another, though with rare exceptions grafting is the better method for established trees. Budding is also necessary where a peculiar root system is desirable, hence for various reasons all, or nearly all, our fruit-bearing trees are "worked" before being planted out.

Buds are inserted when the sap is descending, and inclined to coagulate, and this may be in January, February, or March, according to our position in the State, and the variations of the seasons. The work must always be done before the sap ceases to move, or the wound made on inserting the bud will not heal, and therefore the latter will die. On the other hand, if the bud is inserted when the sap is moving actively and the tree making new growth, the "bud" is almost certain to shoot, and be spoiled, as the weak late shoot would not ripen before the fall, and any other bud coming in the following spring would be very weak compared with that from a bud which remained dormant. Buds must always be placed on healthy and fairly young wood. If the wood and bark are hard the bud will not "take" or at best it will make a very feeble growth. Some buds are taken from wood up to three or four years old. Figs and walnuts are examples of trees which furnish buds from mature wood, but for our ordinary fruit trees wood of the present season is selected, and it is usually inserted in wood of the present or last season at oldest. Otherwise, it is not inclined to "take."

TABLE AND DRYING GRAPES.

Active wood growth should now be at an end, or the fruit will be deficient in quality and late in ripening; and as heat is needed for drying, and also warm weather to create a big demand for table grapes, it follows that everything should be done to produce good grapes in abundance during February. Protect the framework of feeble and young vines, but give full exposure to all wood which refuses to bear fruit. In practice, strong vines should be narrow, so that they do not screen and cool the ground during summer; whilst weakly vines should be allowed to shade the soil and conserve all available moisture, in order that they may continue to grow and strengthen. Grapes which have developed in shade should not be suddenly exposed by the tying up or thinning of shoots, or they will be scorched and checked. The most effective thinning may be done just before the flowers open; but where wood and fruit are overcrowded, and there is danger that disease and confinement will prevent fruit coming to full maturity, the least valuable wood should be cut out, until space is found for each bunch.

THE VEGETABLE GARDEN.

Get manure together that it may be in readiness for dressing ground for autumn and winter crops. A pit or shady corner will conserve all the properties of manure and rubbish, and insure a larger quantity of valuable material than where it is simply thrown into a heap and allowed to get dry. All the cabbage family, celery, potatoes, and quick-growing salad plants will stand rank manure, but it pays best in the long run to get rid of the first fermentation in the pit, as where fresh manure is placed in cool soil it is liable to sour the mass, and prevent free and fine quality growth. Further sowings should be made of cabbage, cauliflower, savoy, and Brussels sprouts. Also lettuce, and silver beet; this is a very hardy vegetable, and apart from the green and the white spine of its leaves furnishing two excellent dishes for the table, it is a most profitable green food for poultry and pigs. A few potatoes may be put in where the soil is moist, and there is no danger of early frosts. Plant out leeks after giving the soil a heavy dressing of manure and a good watering. The leek is a much neglected vegetable which does well over a great part of the State. It also remains good in the ground for fully half the year, is an excellent table vegetable when well prepared, and acts as a seasoning in the place of the onion.

Rank-growing tomatoes must receive no water, but instead, have the tops well thinned, and a number of leaves pinched off, that the main shoots may harden somewhat, and throw out light side growth which will produce flower. Once a fair crop of fruit is well formed the plants should be liberally fed with liquid manure water, and have the bulk of the new shoots pinched off from week to week. No plant will perfect its fruit with fewer leaves than the tomato, and it is the superabundance of foliage which is the most common cause of plants remaining barren, or not ripening a crop until the approach of cold weather.

Rank-growing pumpkins and marrows may be induced to fruit by withholding water, opening out masses of shoots and thinning or lightly thrashing their leaves.

Onions which are well grown should have their tops laid. The bulbs will then swell rapidly, and prove much better keepers than where they are allowed to stand erect till they wither. Further, there is the danger of a shower of rain causing secondary roots, and forcing the bulbs to bolt into seed.

THE HARDY FLOWER GARDEN.

Seasonable operations vary according to the size and style of the garden and the resources and ability of the owner. The vast majority are not really interested in gardening pure and simple, as is illustrated by the surroundings of the average house, but have a liking for some particular flower or plant. What we really want is neat and pleasing surroundings for our country and suburban homes, and these are secured only where a few fine shade-giving trees or shrubs or climbing plants yield bowers of shade. Also a strip of fresh green lawn and creeping things to clothe and beautify our ugly walls of corrugated iron or rough wood fencing. Outbuildings, too, should as far as possible be surrounded with foliage plants of different forms so as to add to the size and comfort of the pleasaunce. At this season our main concern is to keep things green and fresh. It is well nigh impossible to give too much water to ordinary garden plants where the land is well drained, but if bulbs of different kinds are resting in the soil then much water may prove injurious. The planting should always be done in spring and early summer with an eye to having moist and comparatively dry areas so that all one's favorite flowers may get fair treatment.

Fill up any gaps as they occur by sowing in mignonette or nasturtiums, or by planting clumps of sedums or echeverias, cosmos, lupins, phlox Drummondi, petunias, or such other plants as are small and hardy enough to bear transplanting at this season. It is well to always pot up a few things in spring and grow them on with the object of turning them out into such borders as may run bare during February or March. Geranium, fuchsias, coleus, begonias, bouvardias, are a few examples which serve the purpose.

Get material together for making seed beds for autumn sowing. A rich but perfectly sweet and well-drained compost is necessary where annuals and biennials are to stand through their first winter, so choose a warm site, and get the necessary material together at once, for it will take two or three months to rot down and sweeten.

THE TOBACCO INDUSTRY.

Report from the Government Tobacco Farm, Edi, by Temple A. J. Smith.

Though the season for tobacco has not been altogether favorable, the crop at the Government farm looks well. The late spring, followed by a dry December, "only 31 points of rain falling during that month," has caused the crop to be rather backward. Two nice showers of 50 points have, however, fallen this month (January), and the crop looks even and is growing fast. Planting was finished by the first week in December, and all misses filled in by the third week. The cut worm did little damage this season, and the plants held well from the time of transplanting. As soon as the plants were to be plainly seen in the rows the horse hoe was freely used, and the soil immediately round the plants was loosened, the result being at once beneficial. When they reached a height of 6 to 8 inches they were carefully inspected for the green grub, and these were removed, and the bottom leaves, four to five in number, were pruned off and the plant well hilled up, then the horse hoe was again put through the rows and the furrows thrown well from the centre of the row towards the plants. Grubbing has still to be carefully attended to, and in two to three weeks' time the flower-bud will have to be nipped out, care being taken not to allow more than fourteen (14) leaves to remain on the plant, and as the season gets later fewer leaves should be left in order to bring all the plants to maturity as nearly as possible at the same time, and to insure a uniform size and quality of leaf; also early ripening means less risk of loss from frost. The topmost leaves are as a rule small, narrow, and of inferior quality, and take longer to ripen. It was noticed that the moth that produces the grub that does so much damage to the plant was attracted in large numbers to the flowering honeysuckle, and many were killed while feeding thereon. The moth is about an inch and a quarter long, and is very vigorous, making a loud humming sound when flying. The Mason wasp was observed on many occasions to take the grub off the plant and carry it away, and must be considered a valuable friend to the tobacco-grower.

Further information will be forwarded *re* suckering, topping, and general management of the crop next month.

The recent sales of Victorian shipments in London are satisfactory. There are immense stocks of leaf on the English market, and sales of American, by late reports, are not as brisk as usual. Compared with Kentucky tobacco, to which our leaf has been likened, the price obtained, 5½d., is good considering that our leaf is naturally treated with great caution by buyers, who are fearful of altering the flavour of their well-known brands by using an unknown product.

The reports say that the leaf is of good flavour in many cases, but that the packing is not good. This is a matter that should be remedied by experience. The fact that the tobacco itself is of good quality is the main thing, and growers should be encouraged to improve their methods of handling in order to obtain better prices.

AUSTRALIAN LEATHER.

The disabilities under which the use of Australian leather continues to labour, through its exclusion in the contracts made by the British War Office, in so far as the specification for leather for harness and saddlery demands "British tanned," still secure attention from the officials representing colonial industries at home. It must be noted, however, that this does not in any particular refer to Australian hides, the great bulk of which are specially tanned for the soleing of boots of a light character. The hides are not sufficiently heavy to meet the demand for the soles of army boots. The action taken by the authorities representing the Australian States has led to inquiry, and a continuous effort is observed now in the direction of meeting the objections raised against Australian leather. The London tanners and curriers have on more than one occasion stated that the Australian tanning is undoubtedly inferior to British, chiefly on account of colour. The tanning produces a reddish hue. Further, it is found in practice that leather so tanned becomes soft when dressed, and of a spongy nature, thus causing stretching. It does not resist wet and moisture, and hence is not reliable for harness purposes. Such are the alleged defects. It is, however, satisfactory to learn that a distinct improvement is yearly becoming discernible in the colour, appearance, quality, and durability of the leather sent to England from these States.

During the inquiry held by the Royal Commission on Technical Education a few months ago, the condition of the leather-producing industries formed one of the subjects dealt with, and Dr. Cherry, the bacteriologist of the Melbourne University, was instructed to pay special attention to this during the visit he paid to Europe. On his return he reported to the Commission as follows :—"Bacteriology is taught in all the good Agricultural Colleges on the Continent. It has advanced to such an extent that there are now in various towns, such as Hamburg and Frankfort-on-the-Maine, firms which do nothing else but produce commercial bacterial products. These include pure cultures for wines and beers, and in some cases the bacterial growths for manures, and in one or two instances the bacteria used in connexion with tanning, in addition to the bacteria used for the fermentation of cream in dairying.

"The most progressive tanners are turning their attention to bacterial processes. One of the firms I have mentioned in Frankfort-on-the-Maine is now placing the pure cultures of special bacteria upon the market, in order to carry out the various processes connected with tanning without any interference by the putrefactive bacteria. The object is to make use of those bacteria which are necessary to bring about the chemical changes involved in tanning, and to do so without their being in any way interfered with by the putrefactive organisms that are found in abundance on the hides. This is, however, only in its infancy ; but from what I saw in Nottingham and in the German tanneries, there is every reason to think that it will make headway

in the same way as pure cultures in butter have done. The process will be more scientifically accurate. The inferiority of the leather depends, to a large extent, upon the putrefactive processes going on too far. When I was in Nottingham, Sir John Turney, the head of the firm of Turney Bros. and Co. Ltd., was most emphatic as to the loss that has already accrued to Australia through sending home inferior leather, hides, and skins. He said we have lost many millions of pounds, and it was due to the fact that the putrefactive processes were not controlled. This combined with the fact that we have a hot climate, and that putrefactive processes are therefore more difficult to control than in cold countries, leads one to assume that education on that point is much more important here than in colder countries. The greater the difficulties you have to grapple with, the more important it is that our workmen should have a grasp of the problem they have to solve."

Mr. Hubert Burgess, leather manufacturer, of Hawthorn, when giving evidence, stated:"that the necessity for technical education by those engaged in the leather industry has not been recognised here to the same extent that it has been at home. There they have had the example of the Continent and the States, where they have brought technical education up to a very high standard. The people at home saw they would not be able to keep their markets if they did not follow the lead of the Continent. It was forced on them, and they have recognised the utility of technical education. For the last ten years, to my knowledge, speaking particularly in regard to the trade in which I am interested, they have made great strides, to the great benefit of the trade. In England, there are four or five great centres of technical education: London, Leeds, Bradford, and Northampton are the principal ones. At Bradford and Leeds technical education is applied not only to the leather industry, but to the textile. The departments in connexion with the leather trade are conducted on scientific principles; at all these places they have a well-equipped chemical laboratory. The students are of two classes—day students and evening students. The day students are generally the sons of foremen, managers, and proprietors. They pay a considerable fee, attend classes daily, and go through the full course, first, of pure chemistry, and afterwards chemistry as applied to their particular industry, and attend lectures. The evening classes are principally attended by workmen and apprentices, who work during the day time at their trade, and to them a very small fee is charged. One lecture a week is given, and, as a rule, two evenings to practical work in the laboratory. It is strictly enforced that all students attending those evening classes should either take a course of chemistry at one of the polytechnics during the same period they are attending those classes, or they must previously have an elementary knowledge of hemistry.

"After the student at the day classes has a fair knowledge of pure chemistry, he takes chemistry especially applied to his trade; he is taught to analyze the different materials used in tanning; he is also taught the scientific nature of the different processes that go on in the tan yard; he is taken through experimental tanning, and is generally

given a scientific knowledge of the trade which he is studying, so that afterwards, when he enters the tannery, he is able to apply himself intelligently to the trade, and understand from a scientific stand-point the processes which are carried on in the tannery, and by having this knowledge much better results are obtained."

Mr. Burgess entered the Bradford Technical College at fifteen years of age, and the first year was devoted to elementary chemistry and physics, another year was spent on chemistry in the laboratory, and the third year was especially devoted to chemistry as it is applied to the tanning industry.

Referring to the alleged losses on Australian leather through imperfect tanning, he stated—"Mistaken ideas seemed to prevail on this question. The Australians have the skin and they make the best use of it, being well suited to certain classes of work, but however much time given to the tanning of it, it is not possible to make an article to compete with the heavy sole leather of England. Even if the hides were kept in tan three times as long as they are, there is not the weight in the skin. Large quantities are sent home, and a proportion of the very best hides are picked out, put into the pits again, and given a better appearance. Mr. Burgess' attention was directed to a statement made by Sir John Turney as to our losing millions of pounds by our imperfect methods, and he replied that Sir John evidently referred mainly to the great evil brought about by our butchers through the bad taking off of the skin. He agreed that large skins were lost through the butchers' shortcomings. They will not take off the skins decently, and he did not think in any part of the world skins are knocked about and hacked about as they are in this country, both in the branding and flaying, and he considered it high time steps were taken to prevent it. The employés are not up to date here as a rule. There are few in the trade who are very progressive men, but the majority carry on in the same way as their fathers. They are not scientific by any means."

Mr. J. W. Jackson, master tanner, of Bairnsdale, also gave evidence, and stated—"He had studied chemistry at the local School of Mines for two years, and found it of great aid in keeping abreast of the times in tanning. The knowledge he thus gained enabled him to tan more cheaply, gain weight, and turn out a better article."

The Agent-General for Victoria, Sir Andrew Clarke, is ever alive to the interests of our tanners in England. In a letter under date 8th November, 1901, to the Premier, he reports that he sent Captain Arkill to the Shoe and Leather Exhibition, held at the Agricultural Hall that week, to report on this branch of industry. The exhibition is largely visited by boot and shoe manufacturers from all parts of the United Kingdom, and a great deal of business is transacted, one firm alone, it is stated, turning over as much as £25,000 in Australian leather during the few days the exhibition was open.

MEMORANDUM TO THE AGENT-GENERAL.

"In accordance with your instructions, I visited the Shoe and Leather Exhibition at the Royal Agricultural Hall last evening with

a view of ascertaining whether there was anything of interest to report.

There is a very fine exhibit of Australian sides on view, and I had a conversation with several of the leading experts connected with the trade.

There is nothing to add to former reports and suggestions which have been communicated by you to the State, but it may be wise to enumerate and emphasize the following points:—

(1) The most vital question is flaying. Badly flayed sides are worse than branded sides, as little can be done with them. Cattle should be branded on the neck, ear, or cheek, and not on the rump. If the sides were branded as above I am told that the price would be increased fully ½d. per pound. In some cases it is said that a penny per pound above the market price is obtained by clearing out badly flayed and branded sides.

(2) Another suggestion is that each tanner should make a standard of his leather, and keep his shipments up to the same—sides below the standard quality being carefully put aside for sale as seconds.

(3) Another point is the folding of offal. Shoe manufacturers here are said to value the leather by the bend which they get out of the side. The shoulders should be folded in so as to make a bend of about 4ft. 6in. long; the belly should then be folded in about an inch and a quarter out from the flank, *i.e.*, towards the belly.

The above are the most important points mentioned to me which should be observed by tanners when baling up their sides for the home market.

A large proportion of the best hides exported from Australia are sent from Victoria, and during recent years there has been a marked improvement in the condition of the same, but there is much still to be done.

Although Government specifications prohibit the use of Australian leather for military purposes, nevertheless there is no doubt that, owing to recent improvements, a large quantity of our best leather is actually used."

A. W. Arkill.

8th November, 1901.

Such a report in itself is encouraging, yet it discloses faults which demand keen attention at the hands of our manufacturers.

THE ENTOMOLOGICAL AND ORNITHOLOGICAL BRANCH.

INSECTIVOROUS BIRDS OF VICTORIA.

By C. French.

The Nankeen Kestrel.

(*Tinnunculus cenchroides*—VIGORS and HORSFIELD.)

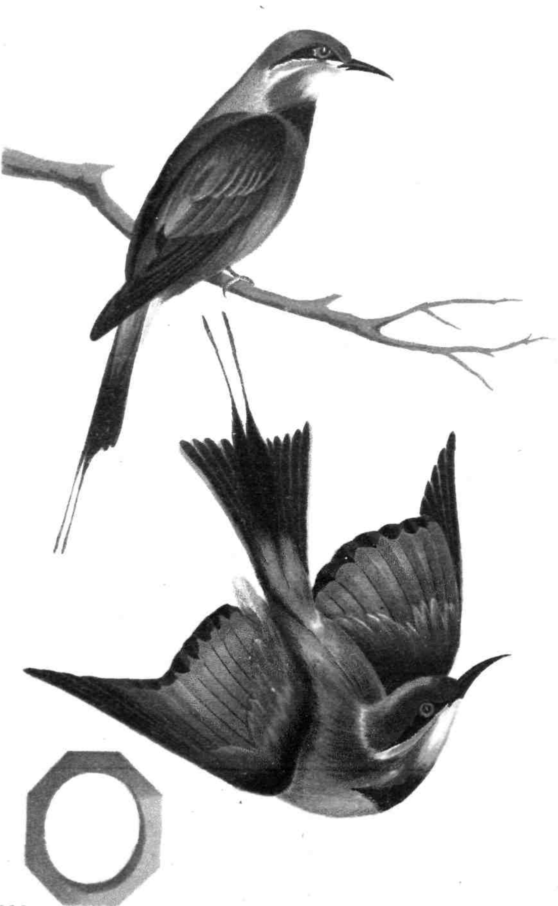
This beautiful bird, with a description of which I will commence my first contribution to the *Journal* on the insectivorous birds of the State, is found over nearly the whole of Australia, and, as our great authority Gould says, "the male has the forehead white; head and back of neck reddish grey, with the shaft of each feather black; back, scapularies, and wing coverts cinnamon red, with a small oblong patch of black near the extremity of each feather; primaries, secondaries, and great coverts dark brown, slightly fringed with white (in future articles the specimens dealt with will be coloured), the base of the minor webs of these feathers white, upon which the dark colouring encroaches in a series of points resembling the teeth of a large saw; face white, with a slight moustache of dark brown from each angle of the mouth; chest and flanks buffy white, with the shaft of each feather dark brown; abdomen and under tail-coverts white; upper tail-coverts and tail feathers for two-thirds of their length from the base grey; remaining portion of all but the two centre feathers white, crossed near the tip by a broad distinct band of deep black, the band being only on the inner web of the external feather; bill brown colour near the base, black towards the tip; base of the under mandible yellowish; cere and orbits yellowish orange; legs orange. The female has all the upper surface, wings, and tail cinnamon-red; each feather of the former with a dark patch of brown in the centre, assuming the shape of arrowheads on the wing-coverts; the scapularies irregularly barred with same, and the tail with an irregular band near the extremity; throat, vent, and under tail-coverts white; remainder of the under surface reddish buff, with a stripe of brown down the centre of each feather."

This pretty hawk is fairly common in most parts of Victoria, feeding chiefly on insects, such as grasshoppers, crickets, grubs, beetles, &c. As a rule this hawk does not attack birds, but is a deadly enemy to mice, which it destroys in large numbers. Mr. Campbell, in his valuable work on the *Nests and Eggs of Australian Birds*, says that the kestrel also destroys small snakes, and justly adds—"Who would kill a bird of such usefulness?" To those who know but little of bird life the kestrel may be known by its colour, also by its small size, the specimen in the office here being exactly 12 inches from tip of bill to tip of tail. The flight of the kestrel, except when it is hunting, is buoyant, easy, and graceful, with

NANKEEN KESTREL.
TINNUNCULUS CENCHROIDES, Gould.

C.C. Brittlebank P.X. C. French, Direx

AUSTRALIAN BEE EATER
MEROPS ORNATUS, Latham



C.C. Brittlebank P.X.

C. French, Direx.

occasional darts forward when in pursuit of its prey. This bird appears to like level or plain country interspersed with light timber, but also frequents bare plains on which a single tree does not exist, such, for example, as the Keilor Plains near Melbourne. In the early fifties, travellers by road from Melbourne to Bendigo were accustomed to see flocks of these birds, sometimes soaring to a great height, and at intervals descending with a rapid skimming flight, also settling on the ground, and so filling themselves with insects that they often rose with difficulty. Things now are vastly changed, the wretched pot-shooter having killed off thousands of these and other useful birds of the early colonial days. The nankeen kestrel builds its nest of branches of trees, and this is lined with smaller twigs, grasses, &c., and is often built in a cliff, or a hollow spout of a tree, which latter position appears to be the one usually selected by the female bird. Mr. A. J. North, in his valuable book on the *Nests and Eggs of Australian Birds*, mentions a nest as being 3½ feet high by 4 or 5 broad, and about 18 inches deep, the nest being built upon the fork of a tree fully 70 feet from the ground. The ground colour of the eggs (usually 4 to 5 in number) is of a dirty white or fawn, freckled all over with reddish brown, the eggs being variable both in size and general colouring. With regard to the nesting, Mr. Campbell and others mention the case of these birds laying their eggs in abandoned nests of the raven, crow-shrike, &c. The kestrel well deserves its reputation as an insect-destroyer, and it is hoped may be protected against all comers.

The next bird to be treated on is the so-called bee eater, a bird concerning the value of which there has been much controversy. It will be observed that, in the interests of plain and popular writings and descriptions, I have adhered to the generic name known to most of us as *Tinnunculus,* believing, as I do, that finality in nomenclature is not a thing of the near future.

The Australian Bee Eater.

(*Merops ornatus*, LATHAM.)

This beautiful bird, as the plate will show, is unlike any other of our Australian birds, not only from the difference in colour, but in shape also, and cannot easily be mistaken. The general plumage of this bird is of a beautiful golden green and azure blue, the feathers of the throat being of a rich yellow. Length of bird, according to Mr. Campbell, 10 inches, including tail 6 inches and bill 1½ inches, the tail feathers assuming a peculiar shape and colour. The habits of this bird are partially migratory, and the birds are to be found in the northern parts of Victoria. They appear in September, and according to Messrs. Campbell and other ornithologists, leave again in March. The eggs, usually five in number, are deposited in holes made mostly in the sandy banks of rivers, the young birds being fairly strong about the middle of January (I have just seen some unfledged birds on the Goulburn, in Victoria).

The bee eater, as its name implies, has a bad reputation as a destroyer of bees, but the strictly insectivorous nature of the bird renders it, with all its faults, much more valuable than many people think. I have seen the holes in which the young are reared strewed with the remains of beetles, plant bugs, moths, &c., and but very few bees, but these latter the parent birds may dissect before feeding their young. The bee eater is one of the most beautiful of our indigenous birds, and, when on the wing, has somewhat the flight of our well-known and much esteemed wood swallows or summer birds of the older colonists, the poise being easy, showing the lovely yellow throat, blue cheek markings, and elegantly tapered bill.

This species is found, according to Messrs. Gould, North, Campbell, and others, in New South Wales, Queensland, Western Australia, South Australia, and in New Guinea. It may be mentioned that these birds are at the present time (January) fairly numerous in the Goulburn Valley, especially near the river, and would appear to be mostly confined to the northern and north-eastern districts. In a note by Mr. Campbell, in his valuable work on oology, he states snakes are frequently found in the holes made by these birds, so the indiscriminate egg-stealer had better beware.

Our next bird will be that general favorite, the superb warbler.

THE POULTERER AT WORK.

THE POULTRY EXHIBIT AT THE GOLD JUBILEE EXHIBITION, BENDIGO.

By A. Hart, Poultry Expert.

The poultry section at the Bendigo Exhibition is similar in character to that which has been presented in the Department's marquee during the past season at a number of agricultural societies' shows, only on a more permanent and extended scale. Great care has been exercised to render this branch of the Department's educational work of the highest practical value to the farmer and his household. In this branch of technical education only those who have taken advantage of the lessons daily given, can fully recognise, not only the commercial gain to those engaged in raising poultry, but also to the masses who are in some form or other associated with fattening, killing, dressing, cooking, and even in the more pleasant operation of carving and eating a fowl. At the lectures and demonstrations, such as are here set out, special attention is devoted in dividing the operations and tuition, to embrace the raising and preparation of poultry for both domestic use as well as for export. Where effort is directed towards raising the most suitable and profitable birds for table purposes, either for home or export, the best types are the Buff Orphingtons and all classes of Wyandottes. It often happens that it is considered best to adopt some form of cross to raise a special combination. Then that between the Indian Game or the Dorking with any of the above classes will produce the most satisfactory results. All the characteristics essential to the development of a good deep breast, delicate and tender flesh, even distribution of fat, well covered back and moderately sized bone, may be obtained by judicious crossing, combined with the application of a rational system of feeding and care. Stress is laid on the importance of commencing with a good selection of well-bred birds, young and healthy, and it is money well spent to purchase from well-known reliable breeders.

The dresser or operator takes the audience through every phase of dealing with poultry for table use. The demonstrations include the killing of the bird, the dressing, and removal of the bones and tendons. The specimens are taken from the chickens on the top row. Then with a needle specially designed for this purpose, threaded with string, the process is shown how to mould the bird into a proper shape ready for cooking. This string is first passed through the wing and breast behind the legs, and on through the opposite wing across the back, firmly tightened and tied. An incision is made in the righ hand side of the fowl near the point of the breast, the leg is bent forward and secured inside, the other one being similarly placed. The string is passed right over the top of the legs, by the aid of the needle, passed back, and tied. The question of seasoning and stuffing is dealt with from several points of view, so as to suit the wishes of the consumer's palate.

Another interesting feature is the method adopted of "larding" the trussed fowl. A firm white square of bacon is used, and cut into strips about 2 inches long, and about ⅛th inch thick. These are attached by means of the needle to the breast in rows about 1¼ inches apart, and this completes the requisite dressing prior to cooking. Larding has advantages which are readily appreciated by the cook. It avoids the tedious operation of basting, less attention is needed in the oven, and the larger gain is more noticed by those who have to eat it, as the bacon imparts a palatable and tempting flavour to the flesh.

The birds on the third row are an exhibit awaiting preparation for export. They are solely set up or dressed with the assistance of the needle and string. This system was introduced by the Department of Agriculture originally when the export of poultry was inaugurated, and as a result of lengthened experience it has been proved to be the most serviceable and best adapted for landing this class of export in the best marketable condition.

Considerable attention is also given towards imparting sound instruction in selecting the best varieties for egg production, such as Leghorns, Andalusians, and Minorcas. Methods of feeding, housing, cleansing, and other useful hints are imparted to encourage the best returns. For instance, visitors are impressed with the advantage of hens setting to hatch eggs from the beginning of June to the end of September. With proper care and suitable food, chickens during these months, when twelve to fourteen weeks old, should weigh about 3 lbs. each, and will readily sell from 5s. to 6s. per pair.

The second row in the exhibit is occupied with egg crates and boxes to give a common-sense idea of the best and cheapest means of packing eggs to avoid breakages and insure their being delivered in a sound condition. The grading of eggs needs expert training to acquire the best returns, and no lack of attention is observable in developing this form of tuition. Eggs, to gain the best market rates, have to be fresh, uniform in size and colour, and clean. A few soiled eggs in a box will lower the value of the lot, and it is better to exclude such. This means that direct attention should be paid to keeping the hens' nests clean. When the boxes are being packed each space is surrounded with a specially prepared greased paper, which renders the operation of packing safe and rapid. Clean sweet chaff may be used, but when fixing the lid care should be observed to render the packing firm by placing layers of newspapers on the top. No space will then be left void to create shifting of the eggs.

The old plan of taking the fowls to market with their legs tied or tumbled into bran bags reduces their value. Nowadays no poulterer would think of paying a high price for fowls delivered in that way. He knows full well what effect the bruising and knocking about has upon the flesh of table fowls. Often the birds are found smothered. On the left of the exhibit is a properly constructed crate made of split cane, 3 feet x 2 feet and 18 inches high, costing from 6s. to 7s., and made by most basket-makers. These are strong, durable, and will last for years. In them fowls can be conveyed to market in the best condition. The

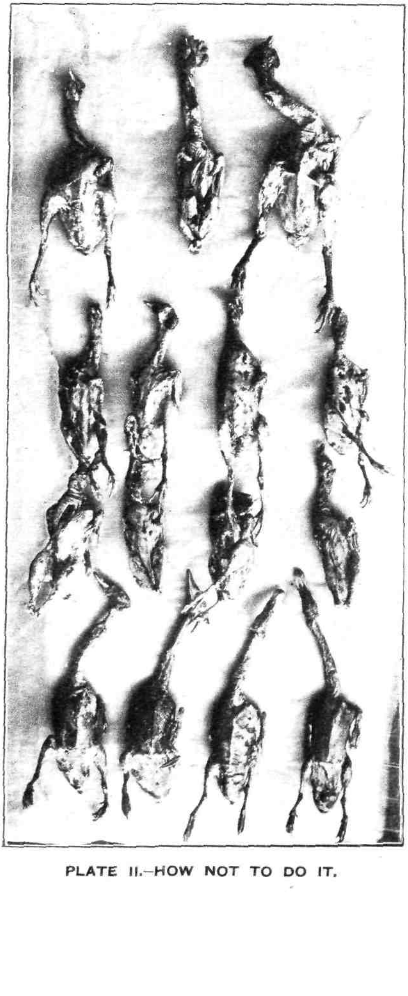


PLATE II.—HOW NOT TO DO IT.

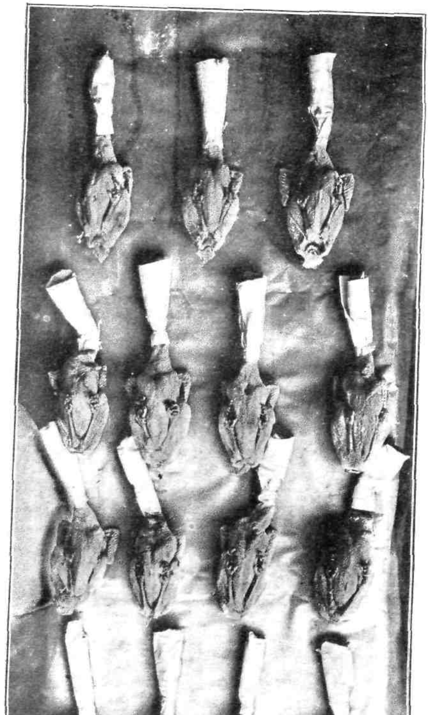


PLATE III.—READY FOR EXPORT.

plucked turkey hanging up on the right is shown to practically demonstrate the bruised flesh caused solely by bad handling and conveyance to market. It has a most objectionable appearance and necessarily its sale is spoiled. Now the leading firms dealing in poultry, either direct or as auctioneers, provide their clients with proper crates.

The illustration Plate II. is a photograph of a number of birds provided by a secretary at one of the country shows for demonstration purposes. He took no precaution to have the birds sent in suitable crates or packages. They were pitched anyhow into a bag, and on being plucked, they were found to be bruised and cut about in this manner. We could do nothing with them, except to have them photographed as an example of "*How not to do it.*" The other illustration, marked Plate III. gives the birds in good condition for the purpose of dressing for export. These demonstrations have aroused a widespread interest in the work as evidenced by the numerous attendances. It thoroughly sets out the value of the instruction. Most people appreciate the pleasure of sitting down to a well-dressed, flavoured, and cooked fowl, more particularly the carver, whose temper is not ruffled with his struggle to dismember the bones or tendons. The cold cooked boned fowl for picnics or race meetings, the cold luncheon for Sundays, are all enhanced by the methods taught the cook at these lectures.

ANIMAL PARASITES.

By A. A. Brown, M.B., B.S.

No. 2.

In this number we commence a discussion on the anatomical characters and life-histories of the cestodes, or ribbon or tape worms. The natural history of these worms has a most important bearing in relation to the health of human beings and of domesticated animals. The cestodes inhabit the alimentary tract of the animals they infest, and they differ widely in their anatomical characters. They all possess a rudimentary nervous system, but all are destitute of a digestive tract. The body is segmented, and each segment possesses both male and female reproductive organs. The form of their body is ribbon-like, and is divided up into a more or less greater number of segments or joints. They vary greatly as regards length. Some may be as short as one-sixth of an inch, whilst others may be 30, or more, feet long. The adult, or sexual tapeworm, is parasitic in the alimentary tract of vertebrate and invertebrate animals. In the course of development of the egg there is an alternation of generations. The tapeworm prolongs its adult life in one animal, but its embryonic existence is passed in the body of another creature. They are introduced into animals that are vegetable feeders by means of water and plants, and into animals which feed on flesh by means of their prey. The cestodes are flat, and possess a head and body which is apparently divided into many segments. The head end is the smallest part of the animal, and the posterior part of the body is the broadest. The body tapers to a point at anterior or head end. In some cases the diminution in size is very gradually accomplished, so that a long narrow portion is observed terminating at a mere point at head end (*Tænia expansa*, sheep). In other cases the narrowing of the segments is quickly effected, so that a short pyramidal head end is formed (*Tænia perfoliata*, horse). The head end is round, and possesses four distinct suckers, surrounded in some species by a crown of hooks. The tapeworms of herbivora have no crown of hooks. The head is continuous with the neck, and the body is divided by transverse constrictions into segments, which at first are very small, but gradually enlarge towards posterior extremity, and so the last segment, which is th oldest, may be comparatively of large size. Each segment i called a proglottis. The worms increase in size by the formation o new proglottides between the head and succeeding segment. Th segment next the head is the youngest, and the last one on the tap is the oldest. Tapeworms are astonishingly prolific. Each proglotti possesses a complete set of reproductive organs, and the number of egg that a single animal can produce is altogether beyond the reach o human conception. When the segments, or colonies, become mature, an no longer require the assistance of the parent stem, they burst asunde the bonds that bind them to their ancestor to commence a distinc existence in order to carry on the round eternal. The last segment

being the oldest, is the first to guide its own destiny; and, successively, other segments keep on drifting away from the parent stem until such time as the parent itself is constrained by some means to forsake the body of its host. The segments, when they have become independent, lie at first free in the intestinal tract, and eventually escape with the dejecta to the outside world, where, on the pastures, they seek for moist situations. The whole body of the tapeworm is covered with a strong cuticle, and this is designed by Nature to protect the worm from the action of the digestive juices of the intestine. If it were not so protected it would undergo elaboration by the agency of the digestive juices. Nature, "a mother kind alike to all," has some justification for the existence of the tapeworm. Though animals thrive better without them, still they are designed for some purpose to invade and live in the alimentary tracts of vertebrates and invertebrates. We are quite unable to explain their use, but that they play some important part in the inscrutable workings of nature is indisputable. Their nutrition is derived from the fluid juices of the intestines by endosmosis or absorption. The juices simply pass through the skin of the worms, since they are devoid of mouth and intestine. They thus feed similarly to plants. Each segment possesses male and female organs, and the ova are fertilized by spermatozoa (male elements) of the same segment. The number of ova (female elements) is enormous, and they may occupy nearly the whole of the segment. As before remarked, the mature independent segments escape from the intestinal tract with the fæces. When deposited in water-pools or damp situations, the wall of the segment decays, and the ova are scattered about. Each individual œvum has a shell covering it, and inside the shell is the developing embryo, endowed with a crown of hooks. The shell is the protective covering of the embryo. It enables it to endure with perfect safety the burning rays of a tropical sun, and the rigours of a polar cold, the drought of the desert, and the humidity of the marsh. It also enables it to withstand the destructive effects of chemical agents. It may remain enclosed in its shell for years, and even perhaps after the lapse of centuries it may still have preserved its vitality. The œvum undergoes no further development until swallowed by some particular animal, in whose body, when it finds a suitable vidus, it progresses further in its development. When swallowed by a particular animal, which constitutes the intermediary host, the shell covering is digested, and the embryo is set free in the stomach. By means of the hooks with which it is furnished, it bores its way into the walls of the intestines, and thus gains the blood stream, and by means of its current it is carried to some organ or muscular structure, or bone. At some spot it fixes itself and enters upon the cystic or hydatid stage of its development. The hooks, which are now no longer required, disappear, and certain changes occur in the cyst. An invagination of the wall of the cyst occurs, and this invagination forms the scolex or head of what will eventually be a tapeworm. In the process of development, some tapeworms, cystici or cystic tapeworms, form bladder-like cysts, which vary much in size, according to species, in the larval stage.

On the other hand, other tapeworms, cystoidei or ordinary tapeworms, do not form bladder-like cysts in the larval stages, and the body of the bladder worm or cysticercoid is solid or nearly so. Cysticercoids are found only in fish, worms, snails, or insects.

The cystici or cystic tapeworms can be divided into two groups:—

(*a*) Those in which the head arises within the cyst by a process of invagination of the wall (cysticercus bovis—the bladder worm of *Tænia Mediocanellata* of man. When full grown, each cysticercus is about $\frac{1}{8}$ to $\frac{1}{5}$ of an inch in diameter. It is the cause of "measles" in beef).

(*b*) Those in which the heads are budded off from special brood capsules attached to the inner surface of the cyst (*Echinococcus polymorphus* or hydatid bladder worm. It may exist in the form of large cysts. The tapeworm, *Tænia echinococcus* is parasitic in the dog, but the hydatid stages are passed in man, ox, swine, and sheep).

Belonging to the division of the cystoidei is a tapeworm in the dog, *Tænia cucumerina*. The larval stage of this worm is passed in the dog louse. The tapeworm of the horse, *Tænia perfoliata*, the tapeworm of the sheep, *Tænia expansa*, and the tapeworms of birds belong to this group.

FOWL TICK.

A Report by A. A. Brown, M.B.

Department of Agriculture,
26th December, 1901.

The Honorable the Minister of Agriculture, &c.

I have the honour to report that, in accordance with your instructions, I left Melbourne on Monday morning, 23rd inst., to visit Pyramid Hill in connexion with the tick outbreak in poultry. On arrival at Pyramid Hill I visited the business premises of Mr. John McKay, a large storekeeper, who is in the habit of buying fowls from farmers all round the district, and consigning them to salesmen in Melbourne. I did not find any evidence of fowl tick in his fowls or in his poultry-yard; but some fowls that he consigned to Messrs. Ambler, Farrel, and Co., King-street, Melbourne, were condemned by me on 18th inst., at Messrs. Ambler and Co.'s, as being tick infested. Mr. McKay, being the medium through which most fowls are sent from Pyramid Hill and surrounding district to Melbourne, was advised to carefully examine all birds, and to reject for transmission any found infested. He is to make examinations on a vacant plot of ground near his property. I then visited the farm of Mr. Gilbert Sloan, on the Durham Ox-road, about 8 miles from Pyramid Hill, and found tick (*Argasides*) on his fowls, and in his fowl-house. He keeps about 200 fowls. At Miss Doherty's farm, Mincha West, tick were found both on fowls and in fowl-house. She runs 40 to 50 fowls. Mrs. Stretch, Mincha, runs 150 fowls, and possesses no fowl-house, but allows them to roost in the trees. The fowls were found, as far as examination went, free of the disease.

On Tuesday, 24th, I visited Mrs. Wm. Quinlan's farm, Mincha West, and found tick on fowls and in the fowl-house. At Mr. Robert Stone's farm, Mincha, tick were found on fowls and in fowl-house. He told me that he noticed the parasites on his place fully two years ago. Mr. Henry Beard, Macorna, who runs a large number of fowls, told me his return last year from his poultry was £200. No evidence of tick was discovered on his premises. Five of his fowl-houses are built of palings, and one is constructed of mud-brick walls with paling roof. Everything appeared to be well conducted here, and the places kept particularly clean. At the fowl-house of the Yeomanry Company, Macorna, which is built of paling, tick were discovered. The Yeomanry Company receive, from all parts of the district, fowls for consignment to Melbourne. I advised Mr. Black, the manager, to carefully examine all fowls before he allows them to be forwarded. He is to make examinations on vacant ground near his property.

General Observations.

Speaking generally, the fowl-houses at the farms in the district are built with rough timber uprights, cross beams, and rafters. The uprights, &c., were not denuded of the bark before being placed in

position. In time the bark commenced to peel away from the wood beneath, and between the bark and wood the ticks find shelter by day in myriads. The sides of the building are constructed of rough timber or palings, or mud-brick, and the roof of thatch. In the thatched roof every provision for the shelter of ticks is to be found. No better harbor for the parasites than buildings such as have been described could be erected. In practically every crevice of such buildings ticks could be found. In the thatched roof they must prolifically abound.

In the adult stage the ticks are nocturnal in habit, and are rarely seen crawling about by day, but at night they issue forth from their hiding places in swarms; and, as soon as day breaks, they again seek their retreats. The females usually lay their eggs in the crevices, and the young even may be born hatched. Thousands and thousands of ticks just hatched were found under the bark and in the various crevices. At a very early stage they gain the bodies of the fowls—some perhaps even being laid on their bodies—and it would appear that many young tick remain on the fowls both day and night, as in every infested place—sometimes few, sometimes many—they were found on the birds' bodies. The fowl-houses at Sloan's, Doherty's, Quinlan's, and Stone's were built of rough timber, with thatched roofs. Mrs. Stretch had no fowl-house, the fowls roosting in the trees. Five of Mr. Beard's fowl-houses were built of paling, and one of mud-brick, with paling roof. The Yeomanry Company's fowl-house was built of paling.

I quarantined the premises of Sloan, Doherty, Quinlan, Stone, and the Yeomanry Company. I have allowed all those whose premises have been quarantined to sell their eggs, but before disposing of them they are to be washed in solutions of formalin. With the exception of Mr. Stone, nobody seemed to be aware that ticks existed in the district, and the action taken in Melbourne first aroused the attention of the residents.

I learnt that everywhere reports concerning mysterious deaths in poultry were common, the people really not knowing the cause. Of course they could not be expected to know, seeing that the ticks in the adult stage were never seen about by day.

The poultry business in the northern districts has assumed considerable proportions; and, indeed, many farmers now consider it their staple industry. There is no limit to its expansion, and that it will become one of the leading industries of the whole of the State there is no doubt. Much care, then, must be exercised in affording protection to poultry-breeders throughout its length and breadth.

Recommendations.

Fowl-houses built of rough timber and with thatched roofs should, in all parts of the northern districts—that is, districts known to be tick-infested—be taken down and burnt; and, in place thereof, corrugated-iron buildings with iron supports should be erected in their stead. The iron buildings should be erected so as to be capable of being readily dismantled, and they should be dismantled from time to time, and the parts washed with solutions of lime and sulphur. The whole inside of the buildings should be well coated with tar, and the outside

covered with Arabic paint, as this would serve to bring about a reduction in the temperature of the building during summer. The roosts should be erected on a framework constructed of smooth, uncracked wood, well tarred, supported from the roof by wire lines. The roosts should be smooth and tarred. The wire should pass through a water-tight cup-like arrangement. In the cup-like vessel should be placed strong solutions of formalin. One part of formalin (Schering's saturated 40 per cent. solution) should be added to 200 parts of water, and this should be renewed every week. Kerosene, or kerosene emulsion, could also be given a trial. Any ticks trying to make their way from the roof down wire would be intercepted at the formalin or kerosene solution, which kills them.

It is no use trying to combat the pest when the fowls are housed in buildings that afford the tick shelter. It would be much better to accustom the fowls to roost in trees, as it would seem, when fowls are roosting under these conditions, that they are not so prone to the attack of the parasites. It would, moreover, be unwise, after pulling down an infested fowl-house, to allow the fowls to scatter and house in sheds of all kinds about the farm. That would only tend to the spread of the ticks. The straw in the nests should be renewed daily, and the old straw burnt. In the straw of the nests ticks collect.

On a farm known to be infested the best plan would be to keep the fowls in one spot, and it would be money well spent to enclose a little run with wire netting and keep the fowls there under the best sanitary conditions. No exchange of birds between different farms should take place, for fear of introducing the pest into yards already clean. Any improvement in breeds should be effected by means of eggs.

The fowls should be dipped from time to time in solutions that are fatal to ticks.

Dips.

The tick (*Argasides*) are very tenacious of life; and I have found, by actual experiment, that infested birds must be kept long submerged in the various solutions. Kerosene and soap emulsion, or a mixture of oil (4 parts), caustic potash, 10 per cent. solution (2 parts), and kerosene (1 part), or strong solutions of formalin, or an emulsion of soap, oil, and formalin, make effective dips.

Dust Baths.

Dust baths, composed of ashes, lime, and some insect powder like pyrethrum, should be distributed over the yards. By providing dust baths fowls would be enabled to disinfect themselves.

State Interference.

The matter has now evidently assumed serious proportions; and, in my opinion, individual quarantining will not effectively meet the situation. I would strongly recommend that quarantine areas embracing every affected district be constituted, and that arbitrary boundaries be fixed. Beyond these areas no poultry should be allowed to pass, and every endeavour should be put forth both by individual

and Government effort to rid the State of the pest. No half measures are of any use against such a destructive and fearful enemy to the poultry-breeder.

CONCLUDING REMARKS.

In connexion with my visit to Pyramid Hill and district, I am to say that Constable Deverall, of Pyramid Hill, was of great assistance. He accompanied me around the district, and, through his instrumentality, I was enabled to cover the ground quickly.

I have the honour to be, Sir,

Your obedient servant,

A. A. BROWN.

ACTINOMYCOSIS, OR LUMPY JAW, IN CATTLE.

By W. J. Cother, G.M.C.V.S.

This disease is very prevalent in different parts of the State, particularly so in the northern districts—it has been confounded with tuberculosis from its resemblance to some of the manifestations of that disease, but from which it differs materially in that the tumours burst and heal up again, which is not the case with tubercular abscesses.

Actinomycosis is caused by a parasite of the barley family called the ray fungus, and is confined almost exclusively to the barley-grass country. That grass having taken almost complete possession of the northern and is rapidly encroaching upon the more southerly districts, a short description of the cause and treatment of lumpy jaw may be of interest to stock-owners.

This disease is characterized by swellings about the head, on the tongue, and upper part of the neck, mostly under the jaw and below the ear. The former usually appear first and extend to the glands below the ear on the same side. The tumour contains a yellow creamy pus, in which small sulphur-coloured bodies can be detected.

The fungus probably obtains entrance by means of the sharp awns of the barley-grass seed or other rough food causing wounds to the membranes lining the mouth, or other portions of the digestive tract, but most commonly the mouth, and inoculates the animals in this way. The infective material is then carried to the seat of the tumour, which suppurates, bursts, and heals up for a time, then again breaks. This may occur several times, until ultimately the head becomes an enormous size. If the jawbone is the seat of the disease, it becomes honeycombed, the teeth fall out, and the animal rapidly becomes emaciated. Occasionally abscesses which burst spontaneously do not recur, that is, when the opening occurs in the most depending part, and the abscess drains itself. In that case only thickened skin remains as evidence. Should, however, any of the pus be retained, the abscess reforms.

Treatment.—When the swelling first appears it should be painted with strong iodine paint or blistered with "Stephen's" ointment, and a drench given containing two drachms of iodide of potassium daily for fourteen days. Should the swelling remain after this treatment, it will be necessary to either let it out or excise it altogether. In the former case it must be opened to its lowest edge, the sac scraped and syringed with some antiseptic, and afterwards treated as an open wound, dressing daily with carbolic oil. Opening is the safer plan for abscesses situated below the ear, or in other difficult pl .ces. For one under the jaw, if it is decided to excise it, the animal must be thrown, secured, and placed on its back, with the nose extended. A longitudinal incision is then made, just cutting through the skin. The operator then works rounds the tumour and removes the growth with his fingers, using knife and scissors when necessary—the former as

little as possible. The wound is then washed out with a carbolic solution, filled with tow soaked in the solution, and stitched up. The following day the tow is removed, and the wound thereafter dressed with carbolic oil or other antiseptic.

In the case of infected bones no treatment is of any avail, and the animal should be fattened as soon as possible and slaughtered. The same remark applies also to the tongue, unless professional assistance is available.

Although there is a difference of opinion as to whether human beings are capable of being inoculated with the disease, yet cases have occurred in them, and it is advisable when handling affected animals, especially when the abscesses are suppurating, to see that the skin of the hands is sound, and to thoroughly wash them immediately after; and also to catch the contents of an abscess, when opening it, on an old bag, which can afterwards be burned. Excised growths should be treated in the same manner.

STATE BUTTER COMPETITIONS.

New Regulations.

The following new regulations have been made for the export butter competitions for prizes offered by the Department of Agriculture, in connexion with the export trade to ports beyond Australasia. These regulations will come into force for the next season's supplies :—

1. For the purpose of these competitions the State will be divided into four districts, called the "Western," "Northern and Wimmera," "North-Eastern and Central," and "Gippsland" districts. The "Western" district will include the whole of the south-western part of the State south from Meredith, on the Geelong-Ballarat railway line, and Maroona, on the Ararat-Hamilton railway line. The "Northern and Wimmera" district will include all factories in the Goulburn Valley, Rochester, Bendigo, Castlemaine, Maryborough, Mallee, and Wimmera districts. The "North-East and Central" district will include the Upper Murray, North-East, Kyneton, and Ballarat districts, to the boundaries of the "Western" and "Northern Wimmera" groups. The "Gippsland" district will include all factories east of Melbourne and south of the Dividing Ranges.

2. Prizes as follows will be given for the best butters exported from each district, together with champion prizes for winners of three certificates :—

Prizes { First, £12 10s., with certificate.
Second, £7 10s.
Third, £5.

Champion, gold medal.

3. Factories manufacturing butter in each district, and exporting same, will be treated as one competitor, irrespective of the number of creameries, or brands they employ.

4. The competition will be voluntary. Formal entries will be received at the beginning of each season. No entry fees are required.

5. In the event of a competitor shipping more than one brand of butter from any district, the average points awarded to the several brands will be taken into account in compiling the result.

6. Competitors sending to the Cool Stores for shipment less than four consignments per month for the months of October, November, December, and January shall not participate in any prize.

7. A sample box may be taken from competitor's consignment during the months of October, November, December, and January, and detained for the purposes of this competition.

8. One box of each brand will be detained each month, then examined by the judges, and points allotted on the basis of comparative money value (on the assumption that a perfect butter is worth 100 points) in the manner following :—

Flavour, including aroma	50 points.
Texture, embracing moisture	30 „
Condition, taking in packing and finish ...	20 „
Total	100 points.

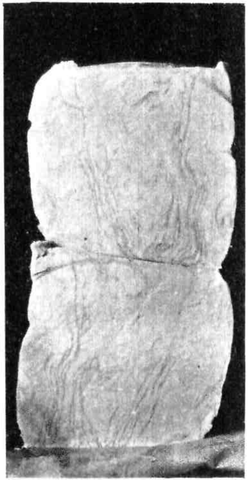
Samples will be taken for chemical analysis and bacteriological examination. The boxes of butter will afterwards be placed in Cool Store for six weeks, and kept at a temperature below 32 deg. Fahr., at the end of which time the butter will be kept at a temperature of 60 deg. Fahr. for two weeks, and then finally examined and judged.

9. The prizes will be awarded to the competitors securing the highest average number of points in the final judging.

10. Three judges, appointed in the following manner, will act:—One selected by the competitors, one by the agents, and one by the Department of Agriculture.

11. If found necessary, butter will be paid for according to arrangement made with shippers before the export season begins.

E. G. DUFFUS,
Secretary for Agriculture.



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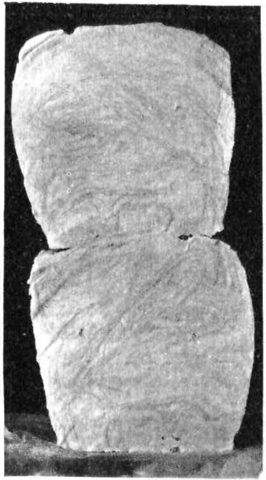

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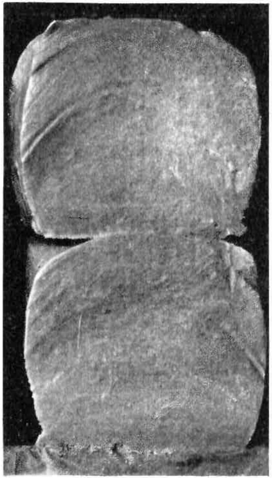
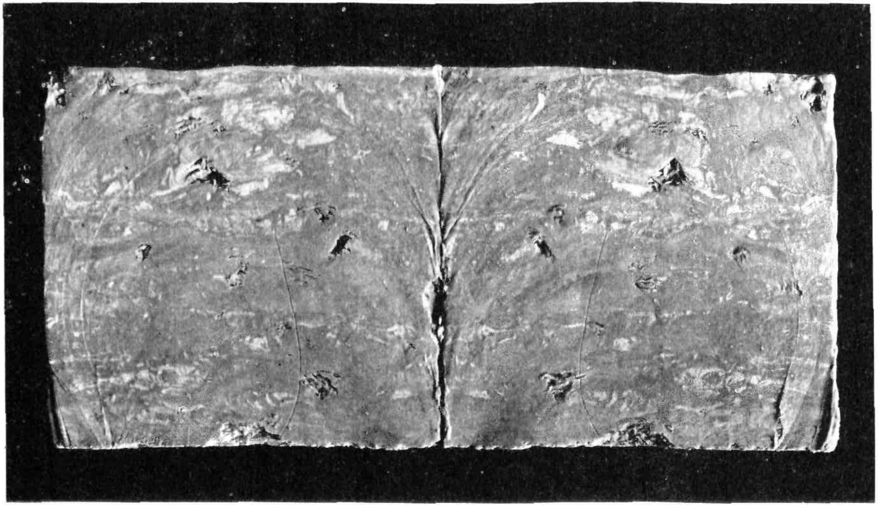


C.

WORKING BUTTER.



MOTTLED BUTTER.

THE EXPORTS BRANCH.

MOTTLED BUTTER.

By R. Crowe.

The fact that 214 instances of mottle, or streak, in butter for export were noted during the past season is sufficient to direct the attention of butter-makers to this subject, even though the manufacturers interested were written to at the time. Every season brings a number of new butter-makers into the business, and it is these specially who require instruction in regard to faults.

The first illustration is that of a box of mottled butter cut in halves. All mottled butter is not marked so plainly as this sample; there are different degrees. In some instances the variation in colour is scarcely perceptible. The chilling or freezing of butter makes the fault more pronounced, so that a case which might be overlooked before the butter is placed in cool store, may be easily observed after the temperature is reduced.

Buyers of butter abroad considerably discount its value when mottle is apparent. Mottle never appears in unsalted butter, excepting on the surface. Butter fades or loses colour in the absence of salt. When the salt is mixed with the butter the colour is retained and becomes more pronounced, therefore, when the salt is imperfectly mixed or distributed, the butter changes in the course of a few hours into two distinct shades of colour. The salt should be distributed evenly and thoroughly mixed into the butter in the first operation of working. The best means of arriving at the point when the salt is sufficiently blended with the butter is to work for a stated time after its addition. To ascertain the period necessary, samples should be taken off at intervals, and kept for 24 hours and then cut and examined. The samples showing variations in colour would be those that were insufficiently mixed or that were not worked long enough. The sample which shows no irregularity in colour, and which has been worked for the shortest time, indicates the period necessary to adopt in order to obviate mottle. The exact time required depends on the class and the speed of the worker in use, the method of the operator, and slightly on the consistency of the butter.

A worker with a double roller will take less time than with only one. A machine making ten revolutions per minute will be quicker than one going round six times. In like manner, if the butter-maker changes the position of the butter for the rollers, as some do, the object in view will be achieved in a shorter time than if only the edges or ends are folded in each revolution. It must be borne in mind that the salting should be thoroughly done in the first working, and the less mixing to secure that end the better for the butter.

The second picture represents butters taken off the worker at different intervals. That marked A was worked for two minutes after the salt was added, B was on the worker for three minutes, and C for four minutes.

CLASSIFICATION OF BUTTER Exported by Country Factories for January, 1901, and January, 1902.

No.	January. 1901.	January. 1902.	No.	January. 1901.	January. 1902.	No.	January. 1901.	January. 1902.	No.	January. 1901.	January. 1902.
1	97·91	98·00	29	95·13	97·00	63	94·48	94·00	97	92·98	95·51
3	96·06	97·76	30	93·36	96·44	64	92·54	97·00	98	92·85	93·21
4	97·33	98·00	31	93·65	97·00	66	93·25	95·73	100	91·26	93·47
5	96·66	97·00	33	94·44	95·00	67	91·83	95·41	102	92·98	94·00
6	96·86	97·19	35	95·25	96·54	68	95·53	94·92	103	95·00	92·00
7	97·25	98·00	36	93·47	96·00	69	94·92	95·60	104	91·95	94·00
8	96·20	97·20	38	93·89	97·14	70	94·00	95·00	105	91·54	93·00
9	96·80	94·72	41	94·95	94·00	71	95·51	95·00	107	90·27	92·46
10	96·59	98·00	42	96·43	97·00	72	91·81	94·00	110	91·71	94·28
11	96·75	98·00	44	95·17	96·13	73	95·77	95·49	112	93·30	93·21
12	97·09	97·11	45	93·81	96·37	74	93·28	95·72	114	91·57	96·00
13	96·91	97·40	47	95·36	96·61	75	94·97	96·42	115	91·45	94·00
14	95·60	97·18	48	94·68	94·15	76	93·65	95·41	118	89·89	89·20
15	96·30	97·00	49	95·98	94·00	77	95·30	95·00	123	92·59	94·00
16	96·62	97·48	51	95·58	95·79	81	94·86	94·00	124	89·96	93·00
17	95·07	97·58	52	93·55	96·08	82	93·69	96·14	127	90·29	92·00
20	96·36	97·00	54	93·93	95·42	85	94·33	95·00	128	90·75	91·00
22	96·41	95·75	55	93·15	94·61	88	93·24	95·44	129	92·11	91·38
23	95·47	97·61	56	92·81	97·00	89	92·94	94·47	130	89·90	93·58
24	96·62	97·00	57	93·03	94·88	91	94·18	96·00	131	92·00	93·00
25	96·87	96·66	58	93·78	96·00	92	95·20	94·68	132	92·57	92·68
26	95·92	96·27	59	95·28	97·00	95	92·86	94·19	134	90·09	93·85

Only factories which exported in January, 1902, are included in this table.

31st January, 1902. R. CROWE, Dairy Expert.

STATEMENT showing Quantities and Average Prices for best quality of Butter exported to Great Britain from Victoria for corresponding periods in the busiest part of the last three seasons.

Shipped for Week ended			1901–2. Quantisy.	1901–2. Price.		1900–01. Quantity.	1900–01. Price.		1899–1900. Quantity.	1899–1900. Price.	
			cwt.	s.	d.	cwt.	s.	d.	cwt.	s.	d.
Oroya,	Sept.	17 ...	1,561	120	0	5,180½	112	9	3,642	105	5
Himalaya,	"	24 ...	1,774½	115	2	5,696½	109	.0	9,708	101	8
Ormuz,	Oct.	1 ...	3,103½	113	10	6,481½	107	1	8,877	102	7
China,	"	8 ...	3,175½	113	10	9,278½	108	0	11,049	104	4
Oruba,	"	15 ...	3,107	113	3	4,777	111	9	11,272½	105	1
Arcadia,	"	22 ...	10,092	110	6	11,790½	111	9	11,902½	104	9
Austral,	"	29 ...	8,694	106	8	11,658	111	6	13,658	104	8
India,	Nov.	5 ...	9,807	106	4	12,064	110	2	13,795½	101	7
Cuzco,	"	12 ...	5,037	105	8	16,780½	111	4	12,400	101	0
Oceana,	"	19 ...	12,370	106	4	16,047	108	6	9,415	100	0
Omrah,	"	26 ...	11,992½	108	0	12,044	113	0	11,313	98	2
Britannia,	Dec.	3 ...	9,461	106	9	10,853½	112	0	8,224½	97	2
Ortona,	"	10 ...	8,880	...		12,103	108	4	15,956½	96	10
Australia,	"	17 ...	8,020	...		11,115	108	2	18,600	100	4
Orizaba,	"	24 ...	6,480	...		9,210½	108	7	10,547½	100	8
Victoria,	"	31 ...	4,980	...		7,013½	110	0	13,795	98	0
Oroya,	Jan.	7 ...	4,003	...		2,406½	107	6	4,874	100	0
Rome,	"	14 ...	1,736½	...		4,896½	104	0	11,282	97	0
Ormnz,	"	21 ...	634	...		16,106	104	0	5,834	96	0
—	"	28 ...	...	...		5,767½	106	0	4,853	93	4
—	Feb.	4 ...	...	...		4,366½	104	0	3,790	93	4
—	"	11 ...	...	...		2,907	104	0	4,263½	92	6

31st January, 1902. R. CROWE, Dairy Expert.

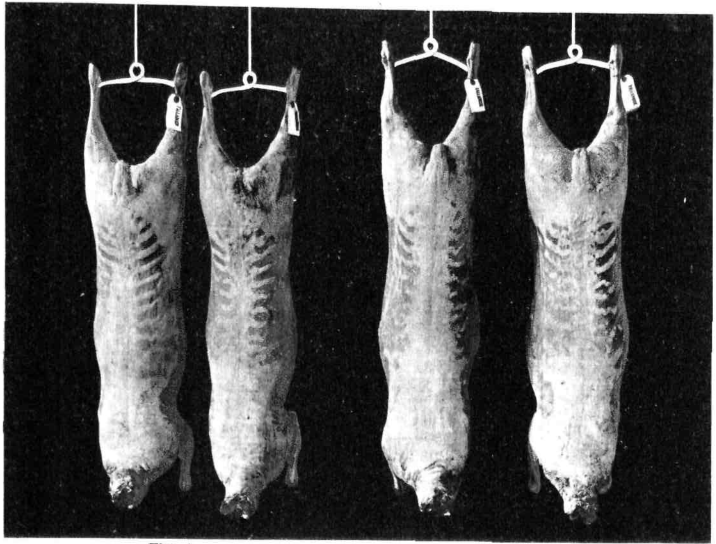


Fig. 1.
A Grade.

PLATE I.

Fig. 2.
B Grade.

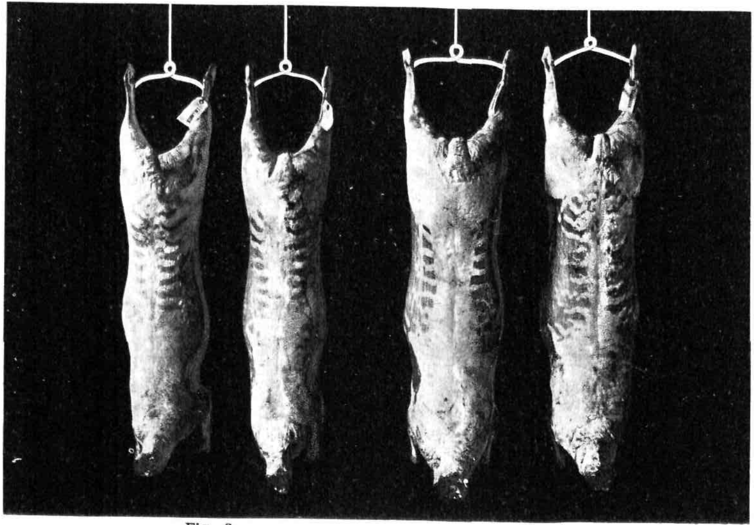


Fig. 2.
L Grade.

PLATE II.

Fig. 1.
H Grade.

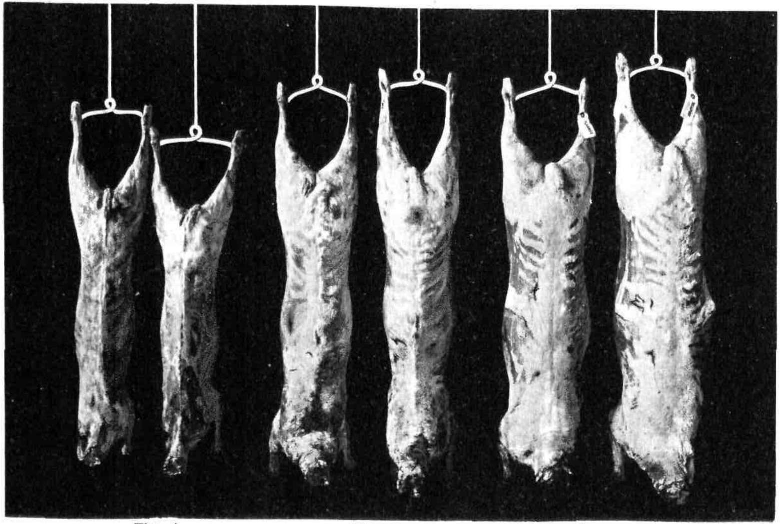


Fig. 1. Fig. 2. Fig. 3.

PLATE III.

GRADING LAMBS FOR EXPORT.

By R. Crowe.

What would be thought of, say, the jam manufacturer who packed 1-lb. and 2-lb. tins of gooseberry and plum jam indiscriminately in the same case for disposal without labels? Or the salesman who offered for competition the various kinds of farm stock in one lot?

Experience has shown the former that different varieties should be carefully labelled to indicate the nature and quantity of the contents; and the latter that more money can be secured by offering, say, cows in milk apart from dry cows, or four-tooth and two-tooth sheep separately.

However, there is no occasion to go outside the lamb export trade for examples to affirm the desirability of grading all lambs for export. Those engaged in the industry who have achieved most success have persistently graded their produce, and now something might be done in the direction of securing uniformity of method, as well as the extension of the principle.

Out of the different systems in operation the following is the most popular. Reference to the set of illustrations will show the various grades:—

Plate 1, Fig. 1.—A grade,	best quality,	weighing	from	28 to 35 lbs.
Plate 1, ,, 2.—B ,,	,,	,,	,,	35 to 42 lbs.
Plate 2, Fig. 1.—H ,,	,,	,,		over 42 lbs.
Plate 2, ,, 2.—L ,,	,,	,,		under 28 lbs.
Plate 3, Fig. 1.—Lambs	rejected for	being		too small and poor.
Plate 3, ,, 2.—	,,	,,		bruised.
Plate 3, ,, 3.—	,,	,,		badly butchered.

When the grading is done just after butchering, different classes can easily be hung separately, and the number of each recorded.

For the months of November and December upwards of 100,000 carcasses were frozen at the Government Cool Stores, therefore it will be seen how necessary it is to improve the position of such a promising trade.

BUTTER FOR THE EAST.

The German trade papers have recently been advising butter packers to ship first-class butter, carefully packed in heavy tin boxes, to the different Chinese ports. Shanghai, they say, takes about £20,000 worth of European butter, packed in ½, 1, and 2-lb. tins, the selling price being about 2s. 6d. per lb. Extra California butter, packed in 1-lb. glass jars, brings 5s. per lb.; but, of course, the sale of such a high-grade article is limited. The packers are advised that a good make of butter, once well introduced, will have a permanent sale. Japan and the Philippines are also said to be promising markets for good butter.

MONTHLY RETURN of Farm Produce Exported and Certified to by the Officers of the Department of Agriculture for January, 1902.

SOUTH AFRICA—

225,573 bales Hay.
315,315 bags Oats.
447 bales Chaff.
24 bags Onions.
500 cases ,,
7,411 bags Flour.

NEW SOUTH WALES—

3,037 bags Onions.
6,279 ,, Potatoes.

QUEENSLAND—

651 bags Onions.
2,427 ,, Potatoes.

WESTERN AUSTRALIA—

40 bags Onions.
74 ,, Potatoes.

TASMANIA—

67 bags Onions.
145 ,, Potatoes.

NEW ZEALAND—

115 bags Onions.
68 ,, Potatoes.

ENGLAND—

1,029 cases Raspberry Pulp.
4 bags Onions.
227 ,, Potatoes.

PARTICULARS of Frozen Produce Exported from Victoria for January, 1902.

—		Shipped through Government Cool Stores.	Shipped through other Cool Stores.	Total Quantity Shipped.
Butter (Victorian) ...	lbs.	1,276,800	8,400	2,022,800
,, ,, (tinned)	lbs.	...	737,600	
,, (Inter-State) ...	lbs.	53,460	...	53,460
Cheese	lbs.	...	240	240
Milk and Cream (concentrated)	cases	895	...	895
Poultry—Fowls and Chickens	head	7,470	975	8,445
,, Ducks	head	1,245	...	1,245
,, Turkeys	head	42	...	42
Eggs	dozen	2,200	680	2,880
Lamb and Mutton	... carcasses	26,600	60,189	86,789
Beef	... carcasses	...	51	51
Calves and Pigs	... carcasses	62	52½	114½
Rabbits	pairs	113,694	6,120	119,814
Sundries	boxes	1,697	...	1,697

1st February, 1902.